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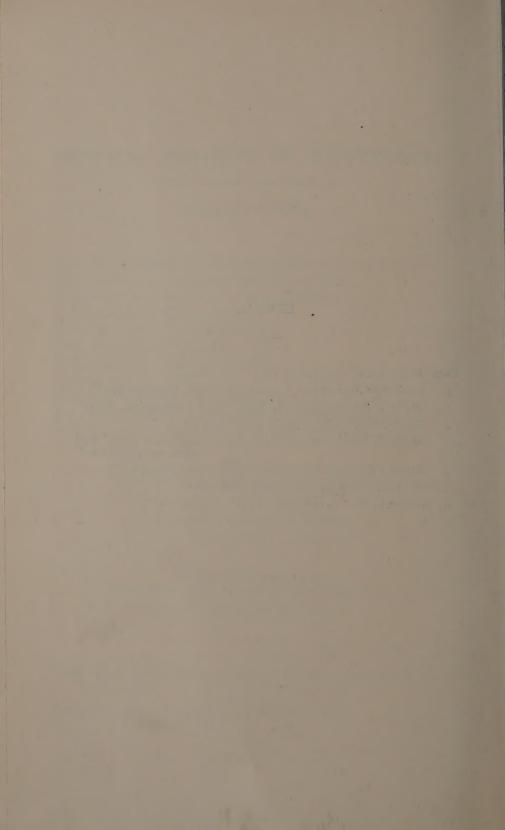
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ERRATA.

Page 10 line 5 for "var. lutus" read "var. elutus"

- " 54 17 lines from end for "hominvorax" read "hominivorax"
- ,, 60 line 8 for "(guesquierei, Parr.)" read "(ghesquierei, Parr.)"
- ,, 79 line 16 for " Lee (J. D.) " read " Lee (D. J.) "
- ,, 89 last 2 lines from end after "gave negative results" add "(with one exception)"
- " 90 line 1 for "Mus minusculus" read "Mus musculus"
- ,, 138 14 lines from end for "000" read "388"
- " 178 line 12 for "A. tesselatus" read "A. tessellatus"



REVIEW

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JOHNSON (H. A.). Notes on the continuous Rearing of Aëdes aegypti in the Laboratory.—Publ. Hlth Rep. 52 no. 35 pp. 1177-1179. Washington, D.C., 27th August 1937.

Observations on Aëdes aegypti, L., were made, chiefly at room temperatures of 70-75°F., with a view to evolving a satisfactory method of rearing for experimental purposes. Like most members of the genus, it lays its eggs just above the surface of the water [cf. R.A.E., B 18 36]. The embryos in freshly laid eggs were undeveloped, but developed to the point of hatching provided that the eggs were kept moist. If the eggs dried up, the young embryos died before reaching maturity. Experiments in which eggs were kept moist on pieces of damp sponge for periods of 20, 48, 72 and 96 hours before drying and subsequent submergence showed that the longer this "ripening" period the more quickly and completely hatching took place. When they were kept moist for more than 96 hours, some of them hatched on the sponges. Of eggs that were "ripened" for 96 hours and subsequently maintained on dry sponges, 75 per cent. or more hatched promptly on submergence after 2 months, but only 50 per cent. or less after 10–12 weeks. The adults lived and reproduced satisfactorily in small improvised cages. They may be expected to take their first blood meal 20-40 hours after emergence, but afterwards will usually feed only at intervals of 2 days, a period that seems to be necessary for digestion. They began to oviposit 4-6 days after the first blood meal, and the egg-laying period after a single feed lasted 3-4 days; the average number of eggs laid after the first blood meal was 6-20. If equal numbers of both sexes were placed in cages and no additions were made, it was invariably noted at the end of 30 days that many of the males had died and very few of the females; thus in captivity the males live for a shorter time. On the other hand, more males than females were always reared from the eggs, and, in nature, this may keep the numbers of the sexes equal. Females properly fed and confined with males produced viable eggs in quantity up to the age of 6 weeks.

Adults have been satisfactorily reared in the laboratory by using the following procedure: To start a colony, females caught in nature are confined in batches of 150-200 without being given a blood meal in cages, 20 by 20 by 16 inches, with cellophane sides and with sleeves for manipulation. Sugar-water on a small ball of cotton wool is kept in the cage as food (especially for males). A piece of wet sponge about the size of a 2-inch cube is put into the cage each day and removed each morning if any eggs have been deposited. Females reared in the laboratory are offered a blood meal each day, either on the arm or on a laboratory animal. The sponges on which eggs are laid are kept moist for 96 hours on wet cotton wool or wet blotting paper, and then allowed to dry naturally. For the eggs to hatch, the dry sponges are immersed in tap water in shallow white enamelled trays for 18-24 hours. The young larvae are fed every 2 days on yeast or pablum (a powdered breakfast food that proved more convenient than yeast), and the water is changed if the odour becomes offensive. Pupae, which usually appear in 7-8 days, are removed to test tubes, which are placed in the cages to await the emergence of adults.

Dickie (W. M.). Fleas, Ticks, and Lice retain Plague Infection after 10 months in Icebox.—Publ. Hlth Rep. 52 no. 35 p. 1179. Washington, D.C., 27th August 1937.

Typical plague infection was produced in guineapigs inoculated in July 1937 with mixed batches of fleas and lice or fleas and ticks taken from ground squirrels, *Citellus beecheyi*, in California on 25th September 1936 and stored for 10 months in an icebox.

DAVIDSON (J. A.) & HUTSON (R.). Control of Northern Fowl Mite.—
Quart. Bull. Mich. agric. Exp. Sta. 20 no. 1 pp. 20-23. East
Lansing, Mich., August 1937.

An account is given of various treatments that were carried out in the spring of 1936 in an attempt to control an infestation of *Liponyssus sylviarum*, C. & F., on fowls in Michigan. The most satisfactory results were obtained with nicotine sulphate applied to the perches in the fowl-houses 3 times at intervals of 3 days, but in laying cages, where this material was difficult to use, the mites were effectively controlled by a single heavy application of sulphur dust to the individual birds.

GARMAN (P.). Bird Mites in a Dwelling House.—Bull. Conn. agric. Exp. Sta. no. 396 pp. 406-407, 1 fig. New Haven, Conn., May 1937.

A brief account is given of the invasion of a house in Connecticut in June 1936 by Liponyssus sylviarum, C. & F. The mites, which were apparently numerous, crawled over the woodwork and beds and caused a kind of eczema on the necks and arms of the persons using the rooms. Large numbers of the mites were found in the empty nest of a flycatcher (Sayornis phoebe), directly above the window of one of the infested rooms. No other possible source of infestation was discovered and no further complaints were received after the nest had been removed. Similar infestations were reported from another

locality in Connecticut and from one in Vermont. Fumigation of infested rooms with naphthalene flakes was apparently effective, for large numbers of dead mites were found after treatment.

MACKIE (D. B.). Entomological Service.—Bull. Dep. Agric. Calif. 25 (1936) no. 4 pp. 455-481, 6 figs. Sacramento, Calif. [1937].

In the course of this report, a brief account (p. 467) is given of the infestation of an apartment house in Sacramento by *Liponyssus bacoti*, Hirst. A grocer's shop on the ground floor provided an abundant supply of food for rats, which were numerous. The mites apparently crawled from them on to the warmer parts of the walls in the vicinity of steam pipes and passed through the openings into the living quarters; the invasion took place nightly. The rats were destroyed, and within a week the mites had been eradicated by spraying with a highly refined kerosene oil and lauryl thiocyanate.

CHAMBERLIN (W. J.). The Ticks of Oregon.—Sta. Bull. Ore. agric. Exp. Sta. no. 349, 34 pp., 11 figs. Corvallis, Ore., June 1937.

In this bulletin is summarised the more important information on the ticks of Oregon; except for records of a few new hosts and data on distribution, most of it has been taken from the literature and from conversation with those engaged in work on ticks. An account is given of the life-history of ticks in general, their economic importance in the United States, the diseases they transmit, how to avoid infestation by them, vaccination against Rocky Mountain spotted fever, and preliminary treatment of this disease. Lists are given of the species known to occur in Oregon (with notes on the more important ones), and of the hosts known to be attacked by them in Oregon and elsewhere; the distribution of some of the species is shown on maps. Appended are a general bibliography, a bibliography of the chief papers published in 1903–11 on Dermacentor venustus, Banks (andersoni, Stiles), and a list of recent articles on Rocky Mountain spotted fever.

Hall (M. C.). Control of Animal Parasites. General Principles and their Application.—Demy 8vo, 162 pp., illus. Evanston, Ill., N. Amer. Vet. [London, Baillière, Tindall & Cox], 1936. Price 10s.

The author gives in military phraseology an outline of the problems of control of various parasites of man and domestic animals in the United States, including Arthropods that cause direct injury or transmit disease. Diagrams indicate the life-history of the various parasites and the methods available for their eradication.

Simmons (S. W.). Some Histopathological Changes caused by Hypoderma Larvae in the Esophagus of Cattle.—J. Parasit. 23 no. 4 pp. 376–381, 6 figs., 6 refs. Baltimore, Md, August 1937.

The following is the author's summary: Some of the principal histopathological reactions resulting from the invasion of the oesophageal tissue of cattle by *Hypoderma lineatum*, Vill., are described and illustrated. Typically the larvae occur in the submucosa and cause inflammatory oedema. The oedema produced about the larvae distorts the submucous connective tissue and occasionally invades the

muscularis mucosa. The infiltration of leucocytes into the pathological area is striking. Most of the haemocytes are eosinophils, lymphocytes, and plasmocytes. In some cases, many of the eosinophils present were myelocytes. Eosinophils may be present at an average density of 476,365 cells per cubic millimetre of tissue. The healing of a larval channel is described and illustrated.

RICH (C. L.) & KNOWLTON (G. F.). Mylasis of Baby in Utah.—J. econ. Ent. 30 no. 4 p. 678. Menasha, Wis., August 1937.

A case of cutaneous myiasis in a baby, caused by maggots of what appeared to be *Wohlfahrtia meigeni*, Schiner, was observed in Utah in 1935. The baby was born on 23rd May, a small rash round the left ear and back of the neck was noticed on 7th June, and an examination three days later revealed small pustules around the left ear, and on the head, neck, back, leg and finger. Recovery was rapid and complete after the removal of the 24 larvae.

Kaston (B. J.). **The Black Widow Spider in New England.**—Bull. New Engl. Mus. nat. Hist. **85** pp. 3-11, 1 map, 9 figs. Boston, Mass., October 1937.

In New England, Latrodectus mactans, F., does not occur in well-built houses, but is found in outhouses, rural privies and barns. Privies should be examined regularly, and the undersides of the seats and corners of the box painted with crossote or crude oil. The blue mud-dauber [Sceliphron coeruleum, L.] preys on the spider [cf. R.A.E., B 305], and its eggs are attacked by one Dipterous and two Hymenopterous parasites.

Belschner (H. G.) & Seddon (H. R.). Studies on the Sheep Blowfly Problem.—Sci. Bull. Dep. Agric. N.S.W. no. 54, 126 pp., 42 figs., 2 maps, 17 graphs, 10 diagrs., 68 refs. Sydney, 1937.

This bulletin comprises five papers, of which the first, a Review of the Sheep Blowfly Problem in New South Wales (pp. 7-60), by Belschner, deals with the distribution, intensity and economic importance of blowfly strike, the predisposition of individual sheep to attack, measures for the prevention and treatment of infestation, and selective breeding as a means of reducing susceptibility. The distribution and importance are influenced by a number of factors, of which the chief are climate (rainfall, temperature and humidity), which affects not only the activity of the flies but also the development on sheep of areas attractive to them and favourable to the maggots, and the type of sheep, which is associated with the predisposition to attack, not only of individual sheep but also of different breeds, Merinos being more susceptible than British or cross-bred animals. Of the different forms of strike, the more important are crutch strike, which is most prevalent in ewes, body strike, which commonly occurs about the withers, back, loin or even along the sides and affects equally both ewes and wethers, and head strike, which usually occurs only in rams. It was found that predisposition to crutch strike was the result not of ill-health, or external factors such as nutrition or management, but of definite physical characters, in most cases a markedly wrinkled conformation of the breech, and in a few distortion of the vulva from accident or

disease. Under conditions of high rainfall, sheep not normally predisposed may become susceptible. The presence of moisture, skin exudation and bacterial activity is necessary before a predisposed sheep becomes susceptible. Body strike follows the development of a condition known as fleece rot, and the susceptibility of individual sheep depends on the quality of the wool, the conformation of the withers and the density of the fleece, particularly over the withers. Observations on head strike suggest that the underlying factor is skin moisture and bacterial decomposition on the skin and wool at the base of the horns, and that such physical factors as the closeness with which the horns lie against the poll and the presence of a deep fold behind the poll are associated with it. It would seem that in all forms of strike, the same underlying factors of moisture and bacterial activity cause the part to become attractive to the fly and provide a suitable environ-

ment for the development of the maggots.

Preventive measures, which comprise jetting, crutching, dipping, removal of folds from the breech (Mules' operation), and the trapping and poisoning of blowflies, and remedial measures, which comprise dressing and jetting, are reviewed, and the extent to which they are employed and the success attending their application are indicated. It is concluded that jetting is of distinct value in preventing strike, but will not replace crutching, and that a combination of both methods is the most satisfactory procedure. Definite information on the value of trapping is not yet available. General observations suggest that the use of poisoned carcasses to kill flies and the destruction of dead sheep by burning reduce the incidence of strike. It would appear that dipping in ordinary arsenical mixtures, such as those used for killing lice, etc., which contain about 0.18 per cent. arsenic, is of no value in preventing strike. Jetting fluids contain a much higher percentage of arsenic (0.9-1.0 per cent.) and do afford protection. The author considers that, although the removal of folds reduces the susceptibility of sheep to strike, it is preferable to eliminate sheep with a wrinkled conformation of the breech by selective breeding. Information collected on the treatment of strike showed that many dressings are in use but that few are entirely satisfactory, and it appears that no satisfactory repellent has yet been discovered for incorporation in a dressing. On the other hand, if the dressing cleans up the breech and has a drying, soothing and healing action that does not result in excessive scab formation, the area is rendered unattractive to the fly for some time. Jetting as a curative measure does not appear to be very satisfactory, since with strong arsenical solutions the skin may be injured and arsenic may be absorbed through the broken surface, and with weak ones, although the struck area may be freed from maggots, re-infestation is liable to occur within a short period. Observations suggest that it is possible by selective breeding to eliminate characters predisposing sheep to strike without necessarily sacrificing bulkiness of fleece, length of staple or general "quality"

The second paper, Observations on Fleece Rot and Body Strike in Sheep, particularly in Regard to their Incidence, Type of Sheep Susceptible, and Economic Importance (pp. 61–95), is also by Belschner. The term fleece rot is used to designate a condition due to the multiplication of bacteria on the skin and overlying wool; it was originally described as water rot [cf. R.A.E., B 19 258] and has also been called weather stain, water stain, dead yolk, etc. The condition predisposes

sheep to body strike and reduces the market value of the wool owing to discoloration and, in some cases, damage to the fibre. It occurs chiefly along the back of the sheep, particularly in the regions of the withers. Prolonged rain that keeps the fleece damp, accompanied by a warm, humid atmosphere, seems to be necessary for its development, so that it occurs only in years when weather conditions are favourable and in types of country where the herbage is high enough to retard the drying of the fleece after rain or heavy dews. Of predisposing conditions associated with the sheep itself, age appears to be the most important. Young animals 6-12 months old are most severely infected (and generally show the highest incidence of body strike), probably because the wool is more open and the skin more soft and mobile so that the water penetrates the fleece more easily. Internal parasitism does not apparently influence the incidence of fleece rot. The incidence was low in sheep with good "quality" wool and high in sheep not so well-bred and with wool lacking the features that constitute "quality." Of these the feature known as "character" is considered the most important, although "handle" and colour are significant; fleeces with good character, soft to handle and bright in colour are insusceptible. Any conformation of the withers that favours the entrance or retention of moisture is also an important factor; sheep with well-formed withers were comparatively free from infection, unless the wool was of poor "quality". Slackness of the wool, especially over the withers, generally denotes susceptibility, although infection may not occur if the withers are of good conformation and the wool of good "quality". Conversely, sheep with wool of poor "quality" are less liable to fleece rot if the wool is dense, for the effect of density is to keep out the water. The reduction of susceptibility depends greatly on breeding and selection; without exception, when fleece rot occurred on an animal with a high grade fleece, some fault in conformation was present. Susceptibility to body strike in sheep is associated almost invariably with the presence of fleece rot, and its prevention depends principally on reducing predisposition to this condition by selective breeding.

In Bacterial Colouration of Wool (pp. 96–110), Seddon points out that in most cases of fleece rot the wool is greyish, dirty yellow or light brown and the bacterial flora is very mixed, but where there is a frank colouration some particular chromogenic organism usually

predominates.

In The Classification of Sheep according to Susceptibility to Blowfly Strike (pp. 111–122), Seddon and Belschner discuss methods of grading sheep according to their potential susceptibility to crutch strike and body strike. The classification is based in the first case on the conformation of the breech, and in the second on quality of wool and conformation of withers. In each case three classes are suggested. It is considered that if the most susceptible types of sheep are eliminated from flocks, there will be a definite decrease in the incidence of crutch and body strike.

In Relationship of Rainfall to Crutch Strike by Sheep Blowflies (pp. 123–126), graphs are given showing the records for rainfall and crutch strike for each year from August 1926 to July 1935. They indicate a general close relationship between the amount of rainfall and the occurrence of strike, and also show that, although total rainfall is important, it is its distribution that affects not only the amount of

strike but also the duration of the waves of strike.

Hobson (R. P.). Sheep Blow-fly Investigations. V. Chemotropic Tests carried out in 1936.—Ann. appl. Biol. 24 no. 3 pp. 627–631, 4 refs. Cambridge, August 1937.

During 1936, tests were carried out on sheep to determine the action of 42 substances as repellents for *Lucilia sericata*, Mg. If the substance was not soluble, it was emulsified in water containing 1 per cent. Agral SRJ; generally a 9 per cent. emulsion was prepared and subsequently diluted 10, 30 and 90 times with a standard attractant solution containing 0.04 per cent. indole and 2 per cent. ammonium carbonate [cf. R.A.E., B 25 53]. The liquid was absorbed on cotton wool, which was tied to the back of a sheep; after 1-2 hours, according to weather conditions, the sheep was brought back from the field and examined for the presence of eggs. The experiments were carried out in duplicate, and parallel control tests were made with the attractant solution alone. No substance was repellent at 0.1 per cent. strength. Those that were repellent at 0.3 per cent. were oils of cloves, pennyroyal and wintergreen, eugenol, safrol, isoquinoline, ortho- and parachlorphenol, benzal chloride, benzyl chloride and a-chloronaphthalene; and further tests will be made with these to determine the duration of their repellent effect and their action on the skin of the sheep. Examination of the blowflies trapped when approaching sheep treated with indole and ammonium carbonate showed that only gravid females of L. sericata are attracted. The chemotropic response depends, therefore, not only on the species, but also on the sex and physiological condition of the fly.

Heim de Balsac (H.). Myiase mortelle chez un loir déterminée par Lucilia ampullacea Villen. Premières données sur la biologie de ce diptère et considérations sur le parasitisme chez les Lucilia.—Bull. Soc. ent. Fr. 42 no. 12 pp. 179–182, 3 refs. Paris, 1937.

A fatal case of myiasis in a dormouse (Glis glis) in France, due to infestation by Lucilia ampullacea, Villen., is described. Allied species of Lucilia are discussed, and it is suggested that each of a number that cause myiasis is related to and possibly derived from a different saprophagous species.

OSWALD (B.). O krpeljima: koje štete uzrokuju i kako da se suzbiju.

[On Ticks: The Damage they cause and their Eradication.]

[In Serbian.]—Yugoslav vet. J. 1937 no. 7 repr. 27 pp., 85 refs.

Belgrade, 1937. (With a Summary in English.)

This pamphlet is intended for veterinary workers in Jugoslavia. It includes a general account of the classification, bionomics and control of ticks and of the diseases they transmit. Lists are given of nine species of ticks found by the author in Jugoslavia and of the tickborne diseases of domestic animals and poultry that occur there. The latter include various forms of piroplasmosis of horses, cattle and sheep, Anaplasma marginale in cattle, and Aegyptianella pullorum and Spirochaeta gallinarum (both of which are transmitted by Argas persicus, Oken) in fowls. Of the seven ticks given in a previous list [R.A.E., B 24 246], the species of Boophilus is now recorded as B. calcaratus balcanicus, Minn., and the species of Hyalomma as H. scupense, Schulze, though some workers consider that the latter is H. savignyi, Gerv. (aegyptium, auct.). The two additional species are A. persicus and Haemaphysalis inermis, Bir.

[Pavlovskii (E. N.).] Павловский (E. H.). Neue Herde des Zecken-recurrens in der Sowjet-Union. [New Foci of Tick-borne Relapsing Fever in the Russian Union.] [In Russian.]—In Pavlovskii (E. N.). Ed. Animaux pathog. pp. 9–22, 8 figs., 2 diagr., 3 refs. Moscow, Inst. Med. exp. USSR M. Gorki, 1936. (With a Summary in German.) [Recd. 1937.]

Of 8 guineapigs, on each of which were fed 4 or more examples of Ornithodorus verrucosus, Olen., Zas. & Fen. [cf. R.A.E., B 23 178] collected in a cave in the environs of Stavropol (North Caucasus), 3 became infected with spirochaetes after an incubation period of 4-5 days. The spirochaetes were present in the blood for 14-29 days. but all the guineapigs recovered, as did others infected by subinoculation. Numerous individuals of O. verrucosus were also found near Tiflis, and their natural infection with spirochaetes was experimentally demonstrated by feeding them on guineapigs, white mice and white rats. The infection was also transmitted to Lagurus lagurus and Allactaga elater. In further experiments, relapsing fever in man was produced by the feeding of ticks from the cave and also by subinoculation of blood of a guineapig harbouring spirochaetes of the Tiflis strain. Up to the present, O. verrucosus has not been found in places where it would normally come in contact with man, which explains the fact that cases of tick-borne relapsing fever are of rare occurrence in the Caucasus.

[Pospelova-Shtrom (M. V.).] **Notional Mathematics** (M. B.). **Ueber Verbreitung, Oekologie und Dynamik der Zeckengattung** *Haemaphysalis*, **mit besonderer Berücksichtigung der Udssr.** [The Distribution, Ecology and Prevalence of the Ticks of the Genus *Haemaphysalis*, with special Reference to the Russian Union.] [In Russian.]—In Pavlovskii (E. N.). Ed. Animaux pathog. pp. 97–104, 22 refs. Moscow, Inst. Med. exp. USSR M. Gorki, 1936. (With a Summary in German.) [Recd. 1937.]

On the basis of data from the literature and an examination of collections of over 12,000 specimens, details are given of the distribution in the Russian Union of the 11 species of *Haemaphysalis* that occur there, together with records of other countries in which they have been found. Notes are also given on their hosts, ecology and seasonal occurrence.

[Petrishcheva (P. A.).] Петрищева (П. A.). Zur Frage über die mutmassliche Rolle kumarinhaltiger Pflanzen bei der Malaria. [Contribution to the Question of the possible Rôle of Plants containing Coumarin in the Epidemiology of Malaria.] [In Russian.]—In Pavlovskii (E. N.). Ed. Animaux pathog. pp. 105–110, 2 figs., 9 refs. Moscow, Inst. Med. exp. USSR M. Gorki, 1936. (With a Summary in German.) [Recd. 1937.]

In view of the suggestion that leguminous plants containing coumarin afford protection against malaria [cf. R.A.E., B **20** 55, 250, etc.], the results are given of several years' observations in malarious districts in Turkmenistan and Tadzhikistan where lucerne (Medicago sativa) is extensively cultivated. Of some 20 species of mosquitos found in lucerne fields during the day, only 0.2-1.5 per cent. were Anophelines and most of these were males, though females were

numerous in adjoining houses and cattle sheds. In the evening and at night, Anophelines represented only 0.1-2.5 per cent. of the mosquitos in lucerne fields, as compared with 15-92 per cent. of those near dwellings and animal quarters. Also, female Anophelines were never observed feeding on the juice of the plants. In Turkmenistan and Tadzhikistan, lucerne has been grown for hundreds of years near villages in old malaria centres. Moreover, lucerne fields require large quantities of water and small defects in the irrigation system result in the formation of swamps that are favourable for the breeding of Anophelines.

[Petrishcheva (P. A.).] Петрищева (П. A.). Die Rolle der Gambusien und einiger einheimischer insektenfressender Fische im Kampf mit der Malaria in Turkmenien. [The Rôle of Gambusia and some indigenous insectivorous Fish in the Control of Malaria in Turkmenistan.] [In Russian.]—In Pavlovskii (E. N.). Ed. Animaux pathog. pp. 111–138, 13 figs., 35 refs. Moscow, Inst. Med. exp. USSR M. Gorki, 1936. (With a Summary in German.) [Recd. 1937.]

A brief account is given of the use of different species of fish against mosquito larvae in the Russian Union since 1911, together with details of work in Turkmenistan in recent years. Gambusia was introduced into Turkmenistan in 1929 [cf. R.A.E., B 24 73] and has since greatly increased in numbers and spread in a system of ponds and ditches that become connected at the time of spring floods. The types of water in which it breeds are discussed. Natural enemies include aquatic birds and beetles, dragonfly larvae, frogs, and the snake, Zamenis karelini. The methods used for transporting Gambusia to different districts in Turkmenistan are described. Laboratory observations on the fecundity of the females showed that 6-7 broods of 60-80 young fish may be produced from April to the end of October. Of the native larvicidal fish, Alburnoides bipunctatus eichwaldi, Varicorhinus heratensis and Nemachilus malapterurus are the most important; notes are given on their habits and the types of water in which they thrive. In the laboratory Alburnoides destroyed more mosquito larvae in a given time than the others, but not so many as Gambusia; Varicorhinus destroyed more than Nemachilus. Suggestions are made for the extended utilisation of these fish in Turkmenistan.

[Petrishcheva (P. A.).] Петрищева (П. A.). Einige blutsaugende Insekten (Culicidae und Phlebotomus) der Sandwüste Karakum. [Some blood-sucking Insects (Culicids and Phlebotomus) occurring in the sandy Desert of Karakum.] [In Russian.]—In Pavlovskii (E. N.). Ed. Animaux pathog. pp. 139–163, 2 figs., 2 graphs, 27 refs. Moscow, Inst. Med. exp. USSR M. Gorki, 1936. (With a Summary in German.) [Recd. 1937.]

In connection with the projected irrigation of the Kara-Kum Desert, which extends over most of Turkmenistan, a survey of blood-sucking insects that may be of medical importance was carried out in 1934 in its south-eastern area. Large numbers of larvae of Culex pipiens, L., were repeatedly found in temporary collections of rainwater in the sun amidst sand-hills, and larvae and pupae, together with those of Theobaldia longiareolata, Macq., occurred in smaller

numbers in wells containing undrinkable salt water. Adults of Aëdes caspius, Pall., and T. longiareolata were abundant in temporary wells with brackish subsoil water. Anopheles hyrcanus var. pseudopictus, Grassi, A. pulcherrimus, Theo., A. superpictus, Grassi, A. sacharovi, Favr (maculipennis var. lutus, Edw.), and 7 species of Culicines were abundant in a large area to which water had already been brought by canals from the river Amu-Dar'ya and where lakes, streams and large swamps surrounded by dense vegetation had formed. Of these, Anophelines formed 97.5 per cent., A. hyrcanus var. pseudopictus and A. pulcherrimus predominating. The rapid spread of the mosquitos into the irrigated part of the desert (about 80 miles in 3 years) may have been partly due to the movements of large flocks of sheep. Serious epidemics of malaria occurred among workmen engaged in the irrigation works in 1931–33.

The sandflies taken were *Phlebotomus papatasii*, Scop., which was the commonest, *P. sergenti*, Parrot, *P. alexandri*, Sinton, *P. caucasicus*, Marz., *P. minutus*, Rond., *P. minutus* var. arpaklensis, Perfil'ev, *P. sumbaricus*, Perfil'ev, *P. squamipleuris*, Newst., *P. chinensis*, Newst., and *P. grekovi*, Khod., all of which were found in huts and tents as well as in the burrows of animals [cf. R.A.E., B 23 51], and a single female of an undescribed species of *Phlebotomus* of the minutus group,

which was taken in the burrows of Rhombomys opimus.

[PAVLOVSKIĬ (E. N.) & SONDAK (V. A.).] Павловский (E. H.) и Сондак (B. A.). Wespen (Polistes gallicus) als mechanische Ueberträger von Invasionen. [Wasps (P. gallicus) as carriers of parasitic Worms.] [In Russian.]—In Pavlovskiĭ (E. N.). Ed. Animaux pathog. pp. 165–173, 8 figs., 7 refs. Moscow, Inst. Med. exp. USSR M. Gorki, 1936. (With a Summary in German.) [Recd. 1937.]

Experiments with *Polistes gallicus*, L., carried out in Abkhazia in 1934 showed that these wasps can pick up eggs of *Necator americanus*, *Ascaris lumbricoides* and *Trichuris* (*Trichocephalus*) trichiura from water and leave them in fresh water when they visit it to drink. Eggs were observed on their wings, legs, and body, but not in their stomach contents, although they were present in the mouth-parts. First-instar larvae of *N. americanus* occurred after two days in the mouth-parts of individuals that had been kept for four hours under a glass cover, together with the eggs of helminths. *P. gallicus* is very abundant in Abkhazia and, since it often crawls about on human faeces in latrines and alights on food, vegetables and plants, it may easily become contaminated with the eggs of helminths and carry them to foodstuffs. Of 20 individuals of *Polistes* taken in a latrine, two had Nematode larvae on their wings. The morphology of the mouth-parts and legs of *Polistes* is described in detail.

[ÉPSHTEĬN (G. V.), MOROZOV (M. A.) & ÉKZEMPLYARSKAYA (E. V.).]
Зпштейн (Г. В.), Морозов (М. А.) и Знаемплярская (Е. В.).
The Rôle of Bedbugs in the Transmission of Variola (Smallpox)
Vaccine. [In Russian.]—In Pavlovskii (E. N.). Ed. Animaux
pathog. pp. 175–180, 4 diagr. Moscow, Inst. Med. exp. USSR
M. Gorki, 1936. (With a Summary in English.) [Recd. 1937.]

In experiments on the transmission of the vaccine of smallpox by bed-bugs [Climex lectularius, L.], batches of 10 bugs were allowed to

feed once on the sites of inoculation of vaccinated rabbits and were then transferred at various intervals to healthy animals. The bugs transmitted the infection for 5 days, and the virus survived in them for up to 12 days. By rubbing suspensions prepared from different organs or the faeces of the bugs into the skin of a rabbit, the virus was shown to be localised in the salivary glands and to a less extent in the faeces; it apparently did not occur in the intestines. Microscopic examination of the salivary glands for the presence of Paschen bodies showed that the virus reproduces actively in them. It was not transmitted mechanically by bugs from which the rostrum had been removed. The bites of only 2 out of 10 infected bugs placed singly in different shaved places on a rabbit 4 days after the infective meal produced positive clinical results. Experiments to test the immunity of rabbits that had been vaccinated by means of bed-bugs were not conclusive. In one out of six cases of the revaccination of man by means of the bite of infected bed-bugs, a typical, though abortive, pustule was obtained.

[ÉPSHTEĬN (G. V.), ÉKZEMPLYARSKAYA (E. V.), SIL'VERS (I. L.) & BABIKOVA (O. N.).] Зпштейн (Г. В.), Знаемплярская (Е. В.) Сильверс (И. Л.) и Бабинова (О. Н.). Bedbugs as Agents of the Transmission of haemolytic Staphylococcus in experimental Animals. [In Russian.]—In Pavlovskii (E. N.) Ed. Animaux pathog. pp. 181–185, 5 refs. Moscow, Inst. Med. exp. USSR M. Gorki, 1936. (With a Summary in English.) [Recd. 1937.]

The transmission of staphylococcus infection by bed-bugs [Cimex lectularius, L.] was studied in Moscow by allowing batches of bugs to feed repeatedly on laboratory animals inoculated with a suspension of haemolytic staphylococci and then transferring them to healthy ones. It was shown that the bugs are able to transmit the infection for up to 15 days. The staphylococci only occurred in the contents of the intestines and in the salivary glands; they appeared in small numbers soon after the infecting feed, did not multiply, and began to disappear 14–15 days later. Infected bed-bugs showed no higher mortality than controls. The infective process was more sharply defined in animals infected through inoculation than in those infected through the bites of the bugs, though it was on the whole very similar.

[Olsuf'ev (N. G.) & Golov (D. A.).] Oncyheb (H. Г.) и Голов (Д. А.). Horse Flies as Transmitters and Conservators of Tularaemia. [In Russian.]—In Pavlovskii (E. N.). Ed. Animaux pathog. pp. 187-226, 12 figs., 6 graphs., 14 refs. Moscow, Inst. Med. exp. USSR M. Gorki, 1936. (With a Summary in English.) [Recd. 1937.]

In view of the fact that cases and even epidemics of tularaemia sometimes occur in the Russian Union among people who have had no association with rodents [cf. R.A.E., B 19 85], but are engaged in work in the open air, especially near water, and in the presence of Tabanids, investigations were carried out in south-eastern Kazakstan in 1934 to determine whether these flies transmit the disease. For this purpose, Tabanids collected in the field were allowed to feed on infected guineapigs shortly before their death, or on carcasses of water-rats (Arvicola terrestris) that had died of tularaemia not longer than 36 hours previously, and were then transferred (singly or in small

batches of a single species) to healthy animals, either immediately or after intervals varying from 10 minutes to 5 days. The species used were Tabanus bromius, L., T. autumnalis, L., T. turkestanus, Szil., T. peculiaris, Szil., T. solstitialis, Schin., T. erberi, Brauer, T. flavoguttatus, Szil., T. karybenthinus, Szil., Haematopota (Chrysozona) turkestanica, Kröber, T. golovi, Olsufev, and Chrysops ricardoae, Pleske, and the infection was transmitted by all except the last two. It was transmitted to guineapigs, rabbits, water-rats, and one of two sheep, but not to a camel, though other workers have observed a case of natural infection of a camel in Western Kazakstan. The flies transmitted the disease mechanically with the proboscis irrespective of whether or not they succeeded in engorging. The most successful results (65 per cent. positive) were obtained with flies that had fed on recently dead water-rats, since Bacterium tularense was more abundant in their blood than in that of the guineapigs. No transmission was effected from the carcass of a rabbit. At 22-24°C. [71.6-75.2°F.], the flies were able to preserve the infection for up to 48 hours, but transmission occurred most often within 24 hours of the infecting feed. In some cases, infection was effected by only one bite, and one fly infected two guineapigs in succession. It was shown by injection of suspensions that the bacterium can be preserved in the stomach of the fly for at least 56 hours.

Though Arvicola terrestris is probably the chief source of infection with tularaemia in the Russian Union, there is some evidence that hares may also be of importance. In experiments by Golov, hares died of tularaemia when infected by nymphs of Dermacentor silvarum, Olen.; the latter also attack A. terrestris [cf. 25 276], and the two

rodents occur in close association in some localities.

SGONINA (K.). **Beobachtungen zur Wirtspezifität von Säuger-Flöhen.**[Observations on Host Specificity in Fleas of Mammals.]—Zool.

Anz. 119 no. 1–2 pp. 44–46, 9 refs. Leipzig, 1st July 1937.

Observations made in Germany showed that Leptopsylla (Ctenopsylla) segnis, Schönh., and Ctenophthalmus assimilis, Tasch., were the only fleas found on the field mouse, Apodemus (Sylvaemus) sylvaticus. L. segnis was also found on Mus minutus. The large mole flea, Hystrichopsylla talpae, Curt., was observed on several species of rodents.

DJONIĆ (S.). **Ueber die Möglichkeit der Verbreitung der Bettwanze**Cimex lectularius **L.** (Acanthia lectularia) **durch die Schwalbe**Hirundo urbica **L.** [On the Possibility of the Spread of C. lectularius by Swallows.]—Zool. Anz. **119** no. 1–2 pp. 46–48.

Leipzig, 1st July 1937. Also in Z. hyg. Zool. SchädlBekämpf. **29**no. 6 pp. 178–180. Berlin, 1937.

In 1933, the author found bugs, said to be Cimex lectularius, L., on 3 nestlings and 11 out of 19 adult swallows in Belgrade. The nestlings were from a nest on a new, uninhabited building. In each of the three following years, he found the bugs on some out of a number of swallows caught in spring on their return from migration. The infested birds included a few that had been bred, ringed and released free from infestation in the preceding autumn, and one that was carrying 132 engorged adult bugs. The author therefore concludes

that the swallows can acquire the infestation in the south where they spend the winter and may be responsible for spreading the bugs from one country to another.

KASSIANOFF (L.). Etude morphologique et biologique de la famille des cimicidés.—Ann. Parasit. hum. comp. 15 nos. 2-5 pp. 97-124, 193-217, 289-319, 386-408, 46 figs., 4 pp. refs. Paris, 1937.

The greater part of this paper consists of descriptions of a number of species of *Cimex* and allied genera and a discussion of their classification; the author concludes that they should all be referred to the genus *Cimex*. Brief notes are given on their distribution and on the question of their ability to transmit disease. The results of laboratory experiments to determine the reactions of *C. lectularius*, L., to various stimuli confirmed the work of other authors, but led to no definite conclusion as to the factors that attract the bug to its host.

HENKEL (H.). Studien zur Entstehung und zum Verlauf einer Aëdes-Plage. [Studies on the Origin and Development of an Outbreak of Aëdes.]—Z. hyg. Zool. SchädlBekämpf. 28 no. 1–6 pp. 17–30, 2 maps, 2 graphs, 9 refs. Berlin, 1936. [Recd. October 1937.]

A plague of mosquitos occurs annually at Hildesheim, in the province of Hanover [cf. R.A.E., B 21 121], and in 1934 it lasted from mid-June to the end of September, Aëdes vexans, Mg., and A. caspius, Pall., being the principal species observed. The chief breeding place was a meadow of about 6 acres near the Innerste river, and there were also two small ones nearer the town. The year 1934 was unusually dry, and consequently mosquitos were scarce. The outbreak at Hildesheim was due to a cloudburst on 7th May; 6 days later the meadow was found to be flooded to an average depth of over 3 ins., and contained numerous mosquito larvae, of which 65 per cent. were A. vexans and 35 per cent. A. caspius. A sample of water taken on 23rd May had a pH of 6.8 and contained 103 mg. lime, 49.5 mg. sodium chloride and a considerable amount of organic matter per litre. The analysis did not therefore indicate a preference of A. vexans for lime, or of A. caspius for salt, as suggested by some authors.

The development of these mosquitos is facilitated by floods, prolonged rains, or local storms. Breeding places may be detected by water-level gauges and by rain-gauges in suspected areas. In spring, at the wettest season, all water-covered surfaces should be mapped, and in summer the gauges should be inspected after rain and the charted surfaces should be carefully examined, as water may be concealed by grass.

MÜNCHBERG (P.). Die Rolle der an Stechmückenlarven als Aussenparasiten lebenden Milbenlarven. [The Rôle of Mite Larvae living as Ectoparasites on Larvae of Mosquitos.]—Z. hyg. Zool. SchädlBekämpf. 28 no. 7 pp. 71–74, 2 figs., 6 refs. Berlin, 1936. [Recd. October 1937.]

This paper includes a review of the literature on the parasitism of pupae and adults of mosquitos by larvae of Hydracarine mites of the

genus Arrenurus (Arrhenurus). In Japan, Miyazaki found that larvae of A. madaraszi, Daday [cf. R.A.E., B 23 131] pass from the pupae of Anopheles hyrcanus var. sinensis, Wied., to the adults. With heavy parasitism, many captive adults died before oviposition and the survivors laid fewer eggs per batch. The author records the finding in Germany of adults of A. maculipennis, Mg., and A. claviger, Mg., parasitised by larvae of Arrenurus, though not so heavily as observed in Japan.

HASE (A.). Ueber Aethylenoxyd- (T-Gas)-Wirkung auf Wanzen bei tiefen Temperaturen. [On the Effect at low Temperatures of Ethylene Oxide (T-Gas) on Bugs.]—Z. hyg. Zool. SchädlBekämpf. 29 no. 3 pp. 65-69. Berlin, 1937.

Bugs [Cimex lectularius, L.] that had been used in a German labour camp in a demonstration of fumigation with T-gas [a mixture of ethylene oxide and carbon dioxide] were investigated by the author, as the fumigation, which lasted 23 hours and for which 75 oz. T-gas was used per 1,000 cu. ft. of wood hutment space, had been effected at a temperature of 14°C. [57·2°F.], falling to 10°C. [50°F.] during the ensuing airing, so that it was always below the lower limit of 15°C. [59°F.] prescribed for T-gas. The bugs comprised 40 adults and 108 nymphs of the 3rd, 4th and 5th instars. They were exposed in glass cylinders, closed at either end with gauze and packed in wrappings, and placed on the concrete floor of the hutment (where the temperature during fumigation was even lower than 10°C.) or hung up. Examination of this material on the following day showed that 4 adults and 13 nymphs were alive and active, but all these died within 24 hours. The remaining 36 adults and 95 nymphs were stiff and none recovered. Nearly all of the 148 bugs had at the hind end a crescent shaped, honey-yellow spot, and it is thought that this may be relied upon as an indication that a bug, even if still active, will die as a result of T-gas. Of bugs kept as controls, 76 per cent. were alive at the close of the observations.

Peus (F.). Wieviele Stechmückenarten gibt es in Deutschland? [How many Species of Mosquitos are there in Germany?]—Z. hyg. Zool. SchädlBekämpf. 29 no. 4 pp. 117-119. Berlin, 1937.

Forty species of mosquitos are known in Germany, but two were first observed as recently as 1935, so that others are likely to be found. Locality records are given for species of limited distribution. Only three, *Culex pipiens*, L., *Theobaldia annulata*, Schr., and *Anopheles maculipennis*, Mg., are regularly found in winter in cellars, so that work in cellars is of no value as a general measure of control.

KARAMCHANDANI (P. V.). Study of 110 Cases of Dengue Fever in the Madras Penitentiary.—Indian med. Gaz. 72 no. 9 pp. 532-534, 28 charts, 2 refs. Calcutta, September 1937.

A brief account is given of 110 cases of dengue fever that occurred in a prison in Madras between 10th October and 7th November 1936. Searches for mosquitos were made at dawn and only 3 examples out of about 3,000 caught belonged to the genus Aëdes, the rest being Culex fatigans, Wied., mostly engorged females. The author concludes that

this mosquito was the vector. Its most important breeding places have not been subject to control measures by the health authorities in Madras; the author has found it breeding in wells.

Shannon (R. C.) & Hadjinicolaou (J.). Greek Culicidae which breed in Tree-holes.—Acta Inst. Mus. zool. Univ. Athen. 1 fasc. 8 pp. 173-178, 3 refs. Athens, March 1937.

An account is given of observations carried out in Greece on the biology of Anopheles plumbeus, Steph., Orthopodomyia pulchripalpis, Rond., Aëdes geniculatus, Ol., A. echinus, Edw., and A. pulchritarsis, Rond., the species of mosquitos known to breed in tree-holes in Europe. In Greece, they are all rare and localised in distribution, largely owing to the scarcity of suitable trees (extensive groups of which are few and confined chiefly to the mountains) and to the fact that the water in most of the tree-holes evaporates early in the summer and the holes remain dry until late autumn. The eggs of Anopheles plumbeus and O. pulchripalpis are not resistant to dessication, so that these two species can only occur where there are tree-holes large enough to maintain a continuous supply of water. In a tree-hole kept full of water artificially for more than a year, larvae of A. plumbeus were found at all dates of examination except in winter, when they were probably at the bottom of the water [cf. R.A.E., B 20 190].

SHANNON (R. C.) & PAPADAKIS (A.). Some comparative Rearing Experiments with Greek Anophelines.—Acta Inst. Mus. zool. Univ. Athens 1 fasc. 8 pp. 179-192. Athens, March 1937.

The authors describe experiments carried out in Greece in which larvae of two or more different species of mosquitos, chiefly Anopheles sacharovi, Favr, A. superpictus, Grassi, and A. maculipennis, Mg., races maculipennis (typicus) and subalpinus, Hackett & Lewis, were exposed in the same container to the same conditions in an attempt to ascertain what factors are of importance in determining the differences that exist between species and are responsible for variations in geo-

graphical distribution and seasonal breeding habits.

The following is largely taken from the summary: In nature, though all three species hibernate in the adult stage, A. sacharovi and A. maculipennis begin to breed in March, whereas A. superpictus does not do so until about a month later. All prefer waters exposed to the sun, except race subalpinus. A. sacharovi and A. maculipennis race messeae, Flni., prefer ponds and marshes, and race maculipennis and A. superpictus streams. Race maculipennis appears to prefer grassy areas, whereas A. superpictus selects those in which there is little or no vegetation, and is frequently found in large numbers in small pockets of water in sand, gravel or among stones, where, particularly in those in sand, they are exposed to the sun throughout the day.

The results obtained from the laboratory experiments help to explain some of the differences in the biology of these species in nature. The eggs of A. sacharovi and A. maculipennis were more resistant to cold and hatched in a shorter time at cooler temperatures than those of A. superpictus. First-instar larvae of the first two species did not survive, for longer than 5 days at 5°C. [41°F.] or less. Larvae of A. superpictus at summer temperatures developed more rapidly and showed a lower

rate of mortality under confined conditions (bowls with a surface diameter of about 8 ins.), than those of the other two species, but all three developed more or less equally well in cement tanks with a surface of about 24 by 32 ins. Full exposure to the sun caused a high mortality; A superpictus was more resistant to this condition and to overcrowding than the other two species. In bowls kept in complete darkness at temperatures of 17.8-20°C. [64-68°F.], the duration of the larval stage in days, and the percentage survival to the pupal stage were 9 and 75 for Aëdes aegypti, L., 10-12 and 92.5 for Culex pipiens, L., 12 and 82.5 for Theobaldia longiareolata, Macq., 12-17 and 57.5 for Anopheles hyrcanus, Pall., 13-17 and 67.5 for A. superpictus, 15-20 and 42.5 for A. sacharovi and 13-21 and 30 for race maculipennis. The wing-length of reared adults varied with the temperature, the smallest being obtained at the higher temperatures and the largest at the lower. A. superpictus is a smaller species than A. sacharovi or A. maculipennis and probably requires less food. It is also more hardy and active in the larval stage. Its activity probably enables it to find food in the small pools of water in stream beds, usually without apparent vegetation or débris, that are one of its usual habitats. It appears to be the most suitable of the indigenous Anophelines for rearing under artificial conditions. More extended experiments on the same lines, but under strictly controlled conditions, are advocated, and various suggestions for them are made.

HOFFMANN (C. C.). Contribución al conocimiento de los mosquitos del Valle del Mezquital. [A Contribution to the Knowledge of the Mosquitos of the Valley of Mezquital.]—An. Inst. Biol. Mex. 8 no. 1–2 pp. 207–215, 4 figs., 1 map, 1 ref. Mexico, 1937.

This second paper on the mosquitos of the Valley of Mezquital, central Mexico [cf. R.A.E., B 25 27], deals with the basin of the Tula river and with the influence of this stream on the regional mosquito fauna. In all dry regions of Mexico, the permanent streams are essentially important for most of the mosquitos, especially in the winter dry season when more or less isolated pools appear in the beds. Breeding in the Tula river is, however, affected by the peculiar composition of its water; it receives some of the sewage water from the city of Mexico throughout the year and also, in and after the rainy season, drainage from the Valley of Mexico, including saline water from Lake Texcoco. A village in the centre of an area irrigated by this drainage was infested with Culex fatigans, Wied., and C. stigmatosoma, Dyar, which bred in domestic water supplies, but its conditions were definitely unfavourable for Anopheles pseudopunctipennis, Theo. Larvae of this Anopheline were found in sunny pools cut off from the Tula river, in which the water had become clear by sedimentation and algae (Hydrodictyon reticulatum) had developed, and those of the northern species, A. punctipennis, Say, in shady pools.

HOFFMANN (C. C.) & NIETO ROARO (D.). Segunda contribución al conocimiento del paludismo en el Valle del Mezquital. [Second Contribution to the Knowledge of Malaria in the Valley of Mezquital.]—An. Inst. Biol. Mex. 8 pp. 293–302, 2 refs. Mexico, 1937.

In continuation of investigations on malaria in the Valley of Mezquital, Mexico, begun at Actopan [R.A.E., B 25 27], surveys

were made in three villages in the basin of the Tula river, and all three forms, Plasmodium vivax, Plasmodium falciparum (immaculatum) and quartan [P. malariae] were found to occur there. Anopheles pseudopunctipennis, Theo., the sole vector in the Valley of Mezquital, had few opportunities for breeding in one of the villages, owing to lack of clean water [see preceding abstract], and the percentage of school children infected with malaria was only 3·34. In the two other villages, where conditions were less unfavourable for the mosquito, the percentages were 14·28 and 6·56.

ZUMPT (F.). Stechmücken-Studien im Pflanzungsgebiet des Kamerunberges. [Culicid Studies in the Plantation Region of the Cameroon Mountain.]—Tropenpflanzer 40 no. 9 pp. 366–383, 8 figs., 18 refs. Berlin, September 1937.

During an investigation in 1936 on tsetse flies in the plantation district of the Cameroon Mountain [R.A.E., B 25 124], the author collected mosquitos and noted their breeding places. The species found comprised Anopheles gambiae, Giles, A. funestus, Giles, A. nili, Theo., A. moucheti, Évans, A. theileri var. hancocki, Edw., Mansonia (Taeniorhynchus) africana, Theo., Eretmapodites chrysogaster, Graham, 5 species of Aëdes, including A. aegypti, L., and 10 species of Culex. Brief descriptions are given of their breeding places, usually with references to the literature. Although examples of all the Anophelines were taken in dwellings, only A. gambiae and A. funestus were abundant enough to be of practical importance as vectors of malaria. In Sierra Leone, both have been recorded as vectors of Filaria (Wucheria) bancrofti [20 281], which also occurs in the plantation district. It is suggested that the pools in which A. gambiae breeds should be oiled within a radius of about half a mile of settlements, supervision being entrusted to the headman, who is the local authority of indirect rule exercised by the British mandatory government. The larvae of A. funestus occur along the banks of brooks and small rivers where vegetation slows the current, and expert European supervision is required for finding and treating the breeding places. They should be dusted, preferably weekly, with a mixture of 1 part Paris green and 50 parts of a carrier; an automatic distributor [21 117] may be used for large surfaces. Oil may be substituted for Paris green where dusting is impracticable.

It is pointed out that in addition to Aëdes aegypti, against which control measures are already enforced, Eretmapodites chrysogaster has been proved capable of transmitting yellow fever [16 236], and that it is abundant throughout the region, breeding particularly in the heaps of cacao shells containing water replenished by the frequent rains. As a precautionary measure, these should be removed or

oil should be applied to them.

KOMP (W. H. W.). The Species of the Subgenus Kerteszia of Anopheles (Diptera, Culicidae).—Ann. ent. Soc. Amer. 30 no. 3 pp. 492–524, 3 pls., 30 refs. Columbus, Ohio, September 1937.

As a result of a study of the adults and larvae, the author recognises seven species of the subgenus *Kerteszia* of *Anopheles*, including three new ones recently collected in Colombia. Characters of the male genitalia, the larvae and the adults of the subgenus are discussed,

and descriptions are given of the adult female of A. boliviensis, Theo. [cf. R.A.E., B 25 48], the adult female, male terminalia and larva of A. cruzi, D. & K., A. bellator, D. & K., A. neivai, H., D. & K., and A. homunculus, sp. n., the male and larva of A. anoplus, sp. n., and the female and larva of A. bambusicolus, sp. n. Larvae of A. homunculus and of A. anoplus were found in water in bromeliads, but those of A. bambusicolus were obtained from small amounts of water contained in the unbroken joints of large bamboo to which the only means of access were small worm-holes. Keys are given to the males (based on the terminalia), females and larvae. The probable identity of species of the subgenus dealt with in some of the more important papers is indicated in lists, the principal changes in nomenclature being the fixing of the name neivai for the species that occurs in Panama and has commonly been recorded as cruzi, and the restriction of cruzi to the Brazilian form in which the male possesses mesosomal leaflets.

Curry (D. P.). Canal Zone Sanitation.—Rep. Hlth Dep. Panama Canal 1936 pp. 20-24. Balboa Heights, C.Z., 1937.

The malaria rate among employees of the Panama Canal and the Panama Railway on the Isthmus was lower in 1936 than any year in the history of the Canal except 1927. The fluctuations in the level of Gatun Lake have been within narrow limits since the construction of the Madden Dam and Lake [cf. R.A.E., B 25 90], much less aquatic vegetation has been exposed on the surface, the numbers of Anopheles albimanus, Wied., produced have been smaller, and the flights into controlled areas reduced. The only species of the subgenus Kerteszia occurring in Panama is A. neivai, H., D. & K. [see preceding paper]. This species breeds largely in the bromeliad, Ananas magdalenae, and is not believed to be a dangerous vector of malaria. F. W. Edwards has confirmed the suggestion that A. tarsimaculatus var. aquacaelestis, Curry, is identical with A. oswaldoi, Peryassú, and that the latter is specifically distinct from A. tarsimaculatus, Goeldi [cf. 22 31]. A list is given of the Anophelines now known from the Canal Zone.

Hodgkin (E. P.). Division of Entomology.—Rep. Inst. med. Res. $F.M.S.\ 1936$ pp. 79–92. Kuala Lumpur, 1937.

KINGSBURY (A. N.). Annual Report of the Malaria Advisory Board (F.M.S.) for the Year 1936.—Med. 8vo, 17 pp., 1 pl. Kuala Lumpur, 1937.

The results of continued observations on the Anophelines of two estates in Selangor [cf. R.A.E., B 24 261] are given. In September 1936, it was discovered that two, or possibly three, species had previously been identified as Anopheles umbrosus, Theo.; the commoner of the two forms that it has been possible to differentiate appears to be new and the other to be A. novumbrosus, Strickl. During the last 15 weeks of the year, 1,255 females of the former and 189 of the latter were dissected and 12 and 2, respectively, were found to be infected with malaria. Investigations on the Anophelines in two villages on the road from Klang to Kuala-Selangor were continued throughout 1936 [cf. 24 261], and observations were begun in August in a third village on the road from Klang to Morib. In contrast to the results of trapping experiments on estates, the

catches of adults in all three areas have been small in comparison with the enormous numbers of larvae collected. The difference may be due partly to the fact that the population on the estates, which is concentrated in coolie lines, attracts more mosquitos than the dispersed population of the villages. It is also possible that the larger numbers of domestic animals present in the villages may attract the mosquitos away from the man-baited traps. Tables show the numbers of adults caught, the numbers infected, the numbers of breeding places in the vicinity of the traps, the numbers of larvae taken, and the results of analyses of 221 samples of water from breeding places.

A study of the action of oils on mosquito larvae was begun in

A study of the action of oils on mosquito larvae was begun in November and, by means of an improved technique, the larvae can now be removed from contact with the oil after a limited period. This method makes it possible to estimate the time taken for the oil to enter the tracheae, whereas the old method, in which the larvae were left in contact with the oil until they were dead, showed the time taken by the oil to kill the larvae after it had entered the tracheae. In an experiment to demonstrate the influence of the thickness of the film on the effectiveness of an oil, batches of 400 larvae were exposed for 10 minutes to four thicknesses of film varying from 0.014 to 0.0036 mm.; the mortality after 24 hours varied with the thickness of the film from 341 to 150.

Jungle has been cleared and rice planted by a large immigrant population in an area adjacent to a village and estate known to be an endemic centre of elephantiasis. A blood survey showed that the inhabitants of riverside villages in the area are infected with Filaria (Microfilaria) malayi, and that filariasis is already present among the immigrant population. In an experiment, 11 species of Anopheles. 6 of Culex, 3 of Mansonia and 2 of Aëdes were fed between 9.30 and 10 p.m. under identical conditions on a man heavily infected with F. malayi. It was observed that some species were much more reluctant to feed than others. Those of which more than 75 per cent. fed comprised Anopheles hyrcanus var. nigerrimus, Giles, A. karwari, James, A. philippinensis, Ludl., Mansonia annulifera, Theo., M. indiana, Edw., and M. uniformis, Theo. Among the specimens of all species dissected, infection was found in 3 out of 57 of the first of these and in 129 out of 182, 2 out of 10, and 11 out of 11 of the last three, respectively; it was also found in 1 out of 19 specimens of A. barbirostris, Wulp, the only ones that had engorged out of the 85 examples given an opportunity to feed. The other mosquitos dissected included 19 of Anopheles hyrcanus var. sinensis, Wied., which has been found to be readily infected in other countries [22 105; 24 191, etc.]. By trapping mosquitos in the villages, it is hoped to discover the actual vectors; although a large number have already been caught only one has so far been found infected, an example of Mansonia uniformis, Theo., which contained more than 50 filarial

A list is given of the numbers and species of Anophelines caught in traps in Kuala Lumpur and collected from the Penang and Singapore mail trains that were dissected during the year; no infections were

detected.

The second paper records the work accomplished and the information obtained during the year on various investigations connected with malaria and its control; much of the information of entomological interest is dealt with in greater detail in the first paper.

Lewthwaite (R.) & Savoor (S. R.). **Division of Pathology. Research.**—Rep. Inst. med. Res. F.M.S. 1936 pp. 108–119. Kuala Lumpur, 1937.

Correlation of the results of cross-immunity tests and experimental infections with clinical, aetiological, epidemiological and serological findings has led the authors to conclude that the rural form of tropical typhus occurring in Malaya and tsutsugamushi disease are identical [cf. R.A.E., B 24 141, 262], and that the second name, being the older, should be retained. A further series of experiments carried out in an attempt to transmit the disease to healthy laboratory animals by the bites or inoculation of suspensions of examples of Xenopsylla cheopis, Roths., that had had an opportunity of feeding on infected animals indicated that the part played by this flea in its transmission is insignificant.

AYROZA GALVÃO (A.) & LANE (J.). Notas sobre os Nyssorhynchus de S. Paulo. IV. Sobre a infecção experimental do Anopheles albitarsis e A. strodei da cidade de São Paulo, pelo Plasmodium vivax. [Notes on the Nyssorhynchus of S. Paulo. IV. On the experimental Infection with P. vivax of A. albitarsis and A. strodei of the City of S. Paulo.]—Folia clin. biol. 1937 no. 3 pp. 65-69, 3 figs., 10 refs. S. Paulo, 1937. (With a Summary in English.)

The city of São Paulo is regarded as being practically a place where Anophelines occur without malaria. Using mosquitos caught there or bred from local larvae, the authors succeeded in inducing 8 females of Anopheles albitarsis, Arrib., and 3 of A. strodei, Root, to feed, on 10th April 1937, on a man harbouring gametocytes of Plasmodium vivax. These mosquitos were dissected on various dates from 17th April to 3rd May. Of the females of A. albitarsis, 4 had stomach infection (190 oöcysts in one case) and 1 also had gland infection. A single example of A. strodei was infected; it was dissected on 25th April and contained only 4 oöcysts.

Utilisation des poissons contre les moustiques.—Arch. Inst. Pasteur Indochine 6 no. 24 pp. 443-505, 5 pls., 3 figs., 9 pp. refs. Saigon, October 1936. [Recd. October 1937.]

In the first paper of this series (pp. 443–461), H. G. S. Morin and P. Martin review briefly the history of the use of fish for the control of Anopheline larvae in anti-malaria work, give lists of the fish that have been employed for this purpose in various countries, discuss the advantages and disadvantages of using indigenous species, quote examples of the practical application of the method in Java, and give notes on precautions that should be taken to ensure the survival of the fish during transport and rearing.

The next two papers, by Morin (pp. 462–464) and by Morin and Martin (pp. 465–469), deal with experiments on the establishment in Indo-China of Lebistes reticulatus (Girardinus guppyi) and Gambusia

affinis, respectively.

The fourth (pp. 470-471) is a list of the fish collected in Indo-China by the anti-malaria service of the Pasteur Institutes, showing the ones that fed on mosquito larvae in the laboratory. In the fifth (pp. 472-475), P. Chevey gives a key to the fresh-water fish of Indo-China, and in the sixth (pp. 476-484), he describes four that may be of

value in the destruction of mosquito larvae. In the last paper (pp. 485–495), Morin and P. Moreau give a brief account of the research that has been carried out by the Pasteur Institutes in Indo-China on the utilisation of indigenous and exotic species of fish. The work has been of an experimental nature, and it is concluded that the problem should now be taken up by the piscicultural authorities, with a view to making tests on a large scale under natural conditions and developing methods for rearing the most suitable fish.

Lemasson (J.). L'utilisation de Gambusia affinis et Girardinus guppyi pour la lutte antimalarienne.—Bull. écon. Indochine 40 fasc. 2 pp. 328-330. Hanoi, 1937.

The desirability of attempting to establish Gambusia affinis and Lebistes reticulatus (Girardinus guppyi) for the control of Anopheline larvae in Indo-China is questioned. A number of examples of Gambusia introduced into ponds in Tonkin bred prolifically between March 1935 and March 1936, and then disappeared completely. Others introduced into a pond in Cochin China increased enormously in numbers between April 1936 and March 1937. If the disappearance of the fish in the first case was due to the unsuitability of biological or ecological conditions, then the fish would have to be specially reared and the expenses incurred would be great. On the other hand, although the climate in Cochin China and Cambodia would appear to be favourable, it is feared that the introduced fish would destroy large numbers of the indigenous varieties that not only form one of the staple articles of food of the natives but are also dried and exported in large quantities. These arguments apply equally well to both species. It is concluded that since the utilisation of larvivorous fish is, at best, only a supplementary measure against malaria, it is undesirable to introduce the exotic species, particularly as there are several widely distributed native species that are not only equally larvivorous but are also of considerable food value.

Kumashiro (S.). Observations and Experiments on the seasonal Prevalence and Attractability of Flies. [In Japanese.]—Nogaku-Kenkyu 28 pp. 346–360. Kurashiki, 1937.

Near Kurashiki, adults of Calliphora lata, Coq., Sarcophaga carnaria, L., and Lucilia caesar, L., are found out-of-doors even in winter. Their numbers begin to increase in April, reach a peak in July, suddenly decrease in August and September, and increase again slightly in October. Among various baits tested, the pupae of silkworms [Bombyx mori, L.] were more attractive than ammonia (50 per cent.), alcohol (20 per cent.), honey (1 per cent.) or esters.

MAKI (T.). The Generation Number of Tetrastichus hagenowi Ratz., an Egg Parasite of Cockroaches, at Taihoku. [In Japanese.]—Kagaku no Taiwan 5 no. 5 pp. 307-309. Taihoku, Formosa, October 1937.

Tetrastichus hagenowi, Ratz., is an important parasite of the eggs of Periplaneta americana, L., and P. australasiae, F., in houses in Formosa. It has six generations from April to December, the lifecycle lasting about a month in summer and about two months from October to December.

[SYMES (C. B.) & ROBERTS (J. I.).] Section of Medical Entomology.— Rep. med. Res. Lab. Kenya 1936 pp. 16-21. Nairobi, 1937.

Work on the control of Anophelines in various parts of Kenya in 1936 is very briefly reviewed. An intensive entomological survey of Mombasa was begun in June, and the results so far obtained indicate that Anopheles gambiae, Giles, is not prevalent on the island (although it is abundant on the mainland); A. funestus, Giles, has not been found on the island. Special surveys were carried out in Kisumu, Kakamega, Nairobi, Malindi and Mombasa to determine the prevalence of Aëdes aegypti, L.; the indices for various types of breeding places in each locality are given. Of the potential vectors of yellow fever, Mansonia (Taeniorhynchus) uniformis, Theo., and M. (T.) africana, Theo., are the only ones that appear to enter houses in numbers; they were very numerous in Kisumu. Breeding places of Aëdes simpsoni, Theo., and Eretmapodites chrysogaster, Graham, were abundant in Mombasa, but adults were rarely caught either in houses or in the bush.

Information on plague and on sprays against mosquitos in aeroplanes has already been noticed [cf. R.A.E., B 25 75, 253]. Measures against Glossina palpalis, R.-D. [cf. 25 165, etc.] were continued; it was observed that gravid females were attracted to newly turned soil in light shade, and large numbers of pupae have been collected from artificial breeding grounds of this type prepared in easily accessible places. Three cases of typhus occurred in a brewery heavily infested with rats and fleas, and the patients stated that they had been bitten by fleas and not by ticks [cf. 25 75]. The Xenopsylla index was 15 per rat. Inoculation of guineapigs with tissue material from rats trapped in the locality and with suspensions of fleas taken from them resulted in the establishment of a strain of virus producing a typhus-like syndrome.

Lewis (D. J.). A new Species of Anopheles from the Anglo-Egyptian Sudan.—Proc. R. ent. Soc. Lond. (B) 6 pt. 9 pp. 181–183, 1 pl., 2 refs. London, 15th September 1937.

The larva, pupa, and adults of both sexes of *Anopheles rupicolus*, sp. n., are described from a locality in the Blue Nile Province. The adults were reared from larvae taken in a deep cleft in the rock and, in small numbers, in a metal water tank.

Gunn (W. R.). Report of the Live Stock Commissioner.—Rep. Dep. Agric. Brit. Columbia 1936 31 pp. P49-P59. Victoria, B.C., 1937.

In the course of this report, work carried out in various districts of British Columbia against warble flies [Hypoderma] in cattle is very briefly reviewed; the progress made is considered satisfactory. Infestations by Dermacentor venustus, Banks (andersoni, Stiles) and D. albipictus, Pack., have been troublesome in certain localities. The latter appears to be spreading gradually over the range country. It seems to be particularly injurious to horses, which are so weakened that it is difficult to restore their condition. Experiments in the course of the last three years have indicated that it can be effectively

controlled by applying standardised derris root in the form of a dust. Treatments were most effective when carried out before the females reached maturity. Promising results have also been obtained in experiments on the use of standardised derris against D. venustus on cattle, and it is hoped eventually to combine the control measures against ticks and Hypoderma.

PAPERS NOTICED BY TITLE ONLY.

- Sharif (M.). On the internal Anatomy of the Larva of the Rat-flea, Nosopsyllus [Ceratophyllus] fasciatus (Bose).—Philos. Trans. (B) 227 no. 547 pp. 466-538, 82 figs., 74 refs. London, 15th September 1937.
- KEMPER (H.). Bettwanzenbekämpfung. [The Control of Cimex lectularius, L., in Germany.]—Z. hyg. Zool. SchädlBekämpf. 29 no. 5 pp. 129–138, 2 figs. Berlin, 1937. [Revd edn, see R.A.E., B 23 222.]
- MERTENS (H.). Feldzug gegen Wohnungsschädlinge. Erfahrungen in England, Schweden, Oesterreich und Ungarn. [A Campaign against House Pests (Cimex lectularius, L.). Experiences in England, Sweden, Austria and Hungary.]—Z. hyg. Zool. Schädl-Bekämpf. 29 nos. 5–6 pp. 139–146, 170–175. Berlin, 1937. [cf. R.A.E., B 25 238, etc.]
- Peus (F.). Massenvorkommen von Halmfliegen (Chloropiden) an und in Gebäuden und Wohnungen. [The Mass-occurrence of Chloropids on and in Buildings and Dwellings in Germany.]—Z. hyg. Zool. SchädlBekämpf. 29 no. 7–8 pp. 207–213, 1 fig., 2 refs. Berlin, 1937. [Revd edn, see R.A.E., B 22 60.]
- NASH (T. A. M.). Advice on Tsetse [Glossina] Surveys and Clearings [in Nigeria]. Revised Edition.—Med. 8vo, 9 pp. Kaduna, Nigeria, Govt. Printer, 1937. [Cf. R.A.E., B 22 173.]
- Bonne-Wepster (J.). Notes on Mosquitoes from the Netherlands Indies. A new Culex and two new Finlaya's from New Guinea.—
 —Meded. Dienst Volksgezondh. Ned.-Ind. 26 no. 1-2 pp. 92-98, 6 figs. Batavia, 1937.
- Ayroza Galvão (A.) & Lane (J.). Notas sobre os Nyssorhynchus de São Paulo (Culicidae Diptera). III. Observações sobre ovos. [Notes on the Nyssorhynchus of São Paulo. III. Observations on Eggs (of Anopheles pessôai, Ayroza Galvão & Lane)].—Rev. Mus. Paulista 23 pp. 23–27, 1 pl., 3 refs. S. Paulo, 30th August 1937.
- Lane (J.) & Ayroza Galvão (A.). Sobre a posição systematica de Anopheles gilesi Neiva 1908. [On the systematic Position of A. gilesi.]—Rev. Mus. Paulista 23 pp. 29-34, 1 pl., 14 refs. S. Paulo, 30th August 1937.
- Zariquiev Alvarez (R.). Contribution à l'étude de la femelle de Phlebotomus ariasi Tonnoir.—Ann. Parasit. hum. comp. 15 no. 5 pp. 409-418, 2 figs., 6 refs. Paris, 1st September 1937.

- DELPY (L.). Notes sur les Ixodidae du genre Hyalomma Koch. II.—
 Hyalomma schulzei Olenev 1931 [descriptions of adults of both
 sexes from camels in Persia].—Ann. Parasit. hum. comp. 15
 no. 5 pp. 419-430, 9 figs., 2 refs. Paris, 1st September 1937.
 [Cf. R.A.E., B 24 196.]
- BODENHEIMER (F. S.). Prodromus Faunae Palestinae. Essai sur les éléments zoogéographiques et historiques du sud-ouest du sous-règne paléarctique. Arachnoidea [including 23 species of ticks with their hosts].—Mém. Inst. Egypte 33 pp. 235–246. Cairo, 1937.
- SUGIMOTO (M.). Notes on the Ticks [including one new species and one new variety] in Kyushu and Okinawa [Loochoo] Islands. [In Japanese.]—Centr. J. Vet. 50 no. 9 pp. 597-615, 4 pls. Tokyo, September 1937.
- SUGIMOTO (M.). On the Nymph and Larva of the Formosan Large Tick, Amblyomma testudinarium Koch 1844. [In Japanese.]—J. Jap. Soc. vet. Sci. 16 no. 1 pp. 11-16, 2 pls. Tokyo, March 1937. [Cf. R.A.E., B 25 291.]
- [PAVLOVSKIĬ (E. N.) & STEĬN (A. K.).] Павловский (E. H.) и Штейн (A. K.). Die Wirkung des Bisses Ornithodorus papillipes nebst seinen Entwicklungsstadien auf Hautgewebe des Menschen. [The Effect of the Bite of O. papillipes, Bir., as well as of its immature Stages on the Skin Tissues of Man.] [In Russian.]—In Pavlovskiǐ (E. N.). Ed. Animaux pathog. pp. 89-96, 4 col. pls. Moscow, Inst. Med. exp. USSR M. Gorki, 1936. (With a Summary in German.) [Recd. 1937.]
- SENEVET (G.). Faune de France. 32. Ixodoidés.—Roy. 8vo [4] 101 pp., 67 figs., 10 pp. refs. Paris. P. Lechevalier et Fils, 1937. Price Fr. 50.
- McIvor (B. C.). A new Species of Ornithodoros Tick from California (Acarina, Ixodoidea) [O. wheeleri, sp. n., attacking man].—J. Parasit. 23 no. 4 pp. 365–367, 8 figs. Baltimore, Md, August 1937.
- Ewing (H. E.). New Species of Mites of the Subfamily Trombiculinae, with a Key to the New World Larvae of the Akamushi Group of the Genus Trombicula.—Proc. biol. Soc. Wash. 50 no. 44 pp. 167–174. Washington, D.C., 28th October 1937.
- Chamberlin (R. V.) & Ivie (W.). The Black Widow Spider [Latrodectus mactans, F.] and its Varieties in the United States.—Bull.

 Univ. Utah 25 no. 8 28 pp., 5 pls. 40 refs. Salt Lake City,
 June 1935. [Recd. November 1937.]
- ROARK (R. C.). List of Publications of the Division of Insecticide Investigations July 1, 1927, to June 30, 1937.—46 pp. multigraph. [Washington, D. C.] U.S. Dep. Agric., Bur. Ent., 1937.

MACLEOD (J.). The experimental Production of cutaneous Myiasis of Sheep.—Parasitology 29 no. 4 pp. 526-529, 6 refs. London, 1st October 1937.

It has recently been shown that oviposition of Lucilia sericata, Mg., on sheep can be induced by the application of chemical attractants [cf. R.A.E., B 25 53], but it has also been found that oviposition will not necessarily result in the development of myiasis or "strike" [cf. 23 227]. As many protective dressings rely on a larvicidal rather than a repellent effect, the necessity for evolving some dependable means of producing strike experimentally is obvious. To produce it at a given point, it is desirable to have a limited focus with a high moisture content next to the skin, surrounded by a zone in which conditions are drier. The larvae will then tend to keep within a circumscribed area, and the irritation they cause will rapidly produce an erythema of the skin. As the skin lesion develops, the exudation from it will gradually replace in function the moisture artificially applied, and the source of this may then be removed. The experimental production of erythema before the larvae are applied should accelerate the development of strike through increasing the local skin temperature and facilitating the commencement of tissue lysis. By using the following method, strike can be produced with certainty at any time of the year. A mild erythema is first produced by placing a little water at the base of the wool at the selected point and rubbing the wet skin with the finger over an area about half an inch in extent. Larvae are placed on the spot, and a compact plug of moist cotton wool is applied over them and held in place by sewing the wool together over it. The plug is generally removed on the second day.

The larvae are obtained by placing a batch of eggs in a small petri dish set in a larger vessel containing water and maintained at a temperature of 30°C. [86°F.]. When they hatch, they crawl out of the dish and drop into the water, and, as they are unaffected by prolonged immersion, may be left there until required. Larvae remaining in the dish are washed into the water, which is then strained through fine muslin. They are then washed off the muslin into a container. By this method the volume of water is reduced, and the thick suspension of larvae can be divided into as many portions as desired. The larvae are conveniently transported to the field as suspensions in water in small vials. The wool is parted and the vial emptied on to the skin at the selected site; the water filters away through the wool and leaves the larvae deposited on the prepared area of skin. The method has also been used with eggs, but not quite so successfully, probably because the plugs dried out and the eggs shrivelled before the larvae hatched. In a few experiments, second-instar larvae reared on meat were also successfully applied, but these larvae should not be left for more than an hour in water as they are markedly less resistant to

prolonged immersion than those of the first instar.

FOTHERINGHAM (W.) & LEWIS (E. A.). East Coast Fever: its Transmission by Ticks in Kenya Colony. Hyalomma impressum near planum P. Sch. as a Vector.—Parasitology 29 no. 4 pp. 504-523, 2 pp. refs. London, 1st October 1937.

The following is based on the authors' summary: The distribution of certain species of ticks in relation to African Coast fever in cattle in Kenya is briefly reviewed. It was thought that the passage of Theileria parva through different species of ticks might throw light on some of the sporadic outbreaks of the disease and on the peculiar character of some of the cases. Transmission by nymphs and adults of Rhipicephalus appendiculatus, Neum., and by adults of R. evertsi, Neum., and R. simus, Koch, was confirmed. Experiments with R. sanguineus, Latr., R. pulchellus, Gerst., and Amblyomma variegatum, F., gave negative results. Exposure of infective nymphs of R. appendiculatus to different degrees and conditions of temperature proved that the ticks remain infective after being subjected to 4–6°C. [39·2–42·8°F.], and 8–10°C. [46·4–50°F.] for 1, 2 and 3 weeks. Exposure to different alternating temperatures for similar periods had no effect on the virulence of the parasite. Ticks exposed to warmth (35–38°C. [95–100·4°F.]) did not survive to the same extent as those exposed to cold. Ticks that survived for one week transmitted the disease.

The association of species of Hyalomma with many different diseases is briefly reviewed. Ticks of this genus in Kenya are not always typical of a species, and there appear to be transitional forms; those used in the experiments all belonged to a form of H. impressum, Koch, that resembles H. planum, Schulze, and is common in most parts of Kenya. They transmitted T. parva in the nymphal and adult stages after the larvae and nymphs, respectively, had fed on an infected animal, but the infection was not passed through the egg.

Daubney (R.). Report of the Chief Veterinary Research Officer.— Rep. Dep. Agric. Kenya 1936 2 pp. 55-100. Nairobi, 1937.

Work on ticks in Kenya [see preceding paper] has been continued by E. A. Lewis. Engorged females, larvae and nymphs of Rhipicephalus appendiculatus, Neum., were exposed for various periods to a continuous temperature of 4°C. [39·2°F.]. Females did not oviposit, but when they had been exposed for as much as 9 days and were then transferred to a temperature of 25-28°C. [77-82·4°F.], they usually laid eggs and most of the eggs hatched. A longer exposure generally killed them. Exposure of the larvae caused a delay in moulting and influenced survival. There was a considerable drop in the numbers that survived after 2 and 3 days, and, in one experiment, only 20 per cent. survived after 4 days. The nymphs were more resistant than the larvae; when exposed for 5 days almost all lived, but when exposed for 10-11 days only 14 per cent. survived. It has been suggested that the virulence of African Coast fever may depend on the site of attachment of the tick, but in experiments in which infective ticks were placed on the tail the disease was readily produced and did not differ from that contracted naturally nor from that produced by the usual experimental methods of transmission.

A strain of *T. annulata* (dispar) was obtained for comparison with *T. parva*. It was transmitted by *Hyalomma mauritanicum*, Senevet [cf. R.A.E., B **24** 246] and by the form of *H. impressum*, Koch, that has been shown to transmit *T. parva* [see preceding paper], but not by *R. appendiculatus*. There appears to be no cross-immunity between the two diseases.

Notes, based on surveys, are given on the local distribution of Glossina fuscipleuris, Aust., and G. palpalis, R.-D., in the western part of the Masai Reserve [see next abstract], and of G. pallidipes, Aust., G. palpalis and G. brevipalpis, Newst., in two districts of Central Kavirondo.

A short account is also given of the results of the work that has been carried out during the year in the Lambwe Valley, South Kavirondo, on the control of *G. pallidipes* [cf. 25 77]. In an attempt to control the fly without completely clearing the area, blocks of bush are being isolated and undergrowth only is being cleared so as to encourage the growth of grass between the bare trunks of the trees. Progress in the reduction in the numbers of fly in two localities is shown in a table.

Lewis (E. A.). Tsetse-flies in the Ol Orokuti Area of the Masai Reserve, Kenya Colony.—Bull. ent. Res. 28 pt. 3 pp. 395-402, 1 map, 12 refs. London, October 1937.

An investigation of the distribution of Glossina in the Ol Orokuti area of the Masai Reserve, Kenya Colony, was carried out early in April 1936. A recommendation had been made that the major portion of the Chepalungu forest area should be allotted to native tribes, and the European farmers feared that herds of native cattle in the forest would attract tsetse flies from the Masai reserve to the vicinity of their farms and that their stock would thus be exposed to infection with trypansomiasis. Some of them believed that fly was steadily advancing up the Mara and Mogor rivers towards the forest and that this advance presented a real danger to further development. The results of the survey are given in detail. It is concluded that there is no evidence to support the belief that the fly is advancing towards the forest; infested belts do not appear to have extended since the previous survey [cf. R.A.E., B 23 77]. The area north and north-west of the Mogor had not previously been surveyed. G. fuscipleuris, Aust., is more widely distributed in Ol Orokuti than was previously known; the presence of G. palpalis, R.-D., on the Ovani (Kayan) river was confirmed. There are indications that one (or both) of these species is responsible for the transmission of trypanosomiasis among animals. The natives are most reluctant to use the excellent grazing in the fly-infested area because of infection with animal trypanosomes and as a result of the mortality among cattle that has been experienced. The movement of additional stock into areas bordering on the fly-infested zones and an increase of traffic on a road running through the fly belt might possibly induce and assist the spread of Glossina, unless some precautionary measures are adopted.

The literature on the distribution of *G. fuscipleuris* is briefly reviewed, and its distribution in Kenya, and particularly in the Ol Orokuti area, is discussed. It appears to prefer the dense bush along the larger rivers, but shows a greater tendency than *G. palpalis* to spread further afield and remain in scattered patches of bush and at the head of small river basins. Its primary home is in the vicinity of water. It does not range over open country in search of food, but waits in shaded places and attacks animals that pass by. It is not readily attracted to man and undoubtedly prefers cattle or game, especially large game frequenting forest and dense bush. It readily attacks cattle, making herds at salt licks restless and in some cases causing them to stampede. It is most active in the morning. It is attracted to and carried by motor vehicles. It was most abundant at an average altitude of 4,800 ft., but has been taken at about 5,900 ft.

No pupae were found.

Stephanides (T.). The Mosquitos of the Island of Corfu, Greece.—

Bull. ent. Res. 28 pt. 3 pp. 405-407. London, October 1937.

Notes are given on the breeding places of 18 species of mosquitos observed on the Island of Corfu in the course of a five-year study in which more than 350 collections of water, ranging from pools to small lakes, were examined. The species of Anopheles comprised A. maculipennis, Mg., which is the principal vector of malaria, A. bifurcatus, L., which is the commonest Anopheline, but is not of great epidemiological importance, because the adults appear too late in the year, and A. superpictus, Grassi. The fact that larvae of A. bifurcatus, a relatively innocuous species, were replaced by those of A. superpictus when the bushes round a certain breeding place were removed suggests that the presence of brushwood along mountain streams may be of some importance in the prevention of malaria. Aëdes aegypti, L. (fasciatus, F.) is abundant; the adults of this species and those of Culex pipiens, L., are the ones most frequently found in houses.

Mosquito larvae in Corfu are very scarce in large, open, deep and permanent bodies of water, but are plentiful in small, temporary collections or on the margins of large but shallow bodies of water, and, in the case of certain species, in bays and pools along the course of slow-running streams. The principal reason for this is that mosquito larvae can complete their development in temporary collections of water that are unsuitable for their chief natural enemies, the larvae of beetles and dragonflies, which have a life-cycle that may take as long as five years. Care must therefore be taken that measures such as drainage and the application of insecticides are not employed in places

where they destroy the latter rather than the former.

RICE (J. B.) & BARBER (M. A.). The Varieties of Anopheles maculipennis in a Region of Greek Macedonia.—Bull. ent. Res. 28 pt. 3 pp. 489-497. London, October 1937.

An account is given of observations made during the years 1932–36 on the forms of Anopheles maculipennis, Mg., that occur in an area of Greek Macedonia about 25 miles long and 12 miles wide adjoining the Aegean Sea. The following is taken largely from the authors' discussion and summary: Throughout the region the habits and morphology of the forms were almost uniform, but on the basis of the sculpturing of the egg two groups were distinguished. These were provisionally called typicus and messeae, Flni., but there was so much variability in them that it will be necessary to use statistical methods to establish them as valid varieties. The amount of variability is not uniform over the whole region; in some localities the egg-type is nearly all typicus, in others it is predominantly messeae. An attempt was made to test the validity of this characteristic, especially with regard to its persistence from parent to offspring and its constancy in varying environments.

In the laboratory the egg-type is, as a rule, constant through one generation, but in exceptional cases females from eggs of type messeae laid eggs of type typicus. The only factor common to all messeae breeding places in the region studied is the presence of water more or less permanently stagnant. In an experiment to ascertain whether the egg-type is determined by the environment, eggs of type messeae were reared in a tank fed by water from an underground spring (a typicus habitat) but only one out of 12 of the egg-batches obtained

from the adults that emerged showed any characteristics of typicus. Certain natural habitats were observed in which, during the course of years, typicus replaced messeae, and there was usually some change in their nature. One characteristic of the eggs, the length of the columellae, may be altered by a change in temperature during the maturation of the eggs in the adult. Large numbers of males of messeae were released in a locality where varieties other than typicus had rarely been found, but little evidence was obtained to show that these males exerted any influence on the type of subsequent generations. There is evidence that the two local forms are really separate entities and not a single highly variable variety, but they appear to lack the definiteness and stability ascribed to typicus and messeae as found in other countries, where the environment may be more stable or where geographical isolation may have established these varieties more firmly.

JACK (R. W.) & WILLIAMS (W. L.). The Effect of Temperature on the Reaction of Glossina morsitans Westw. to Light. A preliminary Note.—Bull. ent. Res. 28 pt. 3 pp. 499–503, 3 figs., 2 refs. London, October 1937.

In the course of studies in Southern Rhodesia on the behaviour of Glossina morsitans, Westw., observations were made on its phototropic reactions. A special cage was divided by a movable partition into two approximately equal sections, both of which could be heated but one of which was dark and the other lit by a 100-watt electric lamp, the rays of which passed through a water screen to eliminate the heat. The reaction of the flies to light at normal indoor temperatures is positive, but it was found that if the temperature of the light section of the cage was raised above 30°C. [86°F.] the reaction became negative and the flies sought the darkened section, regardless of whether the temperature in the dark section was below, equal to or above that in the light section. The flies would leave an uncomfortably high but not immediately fatal temperature of 42°C. [107·6°F.] in the light section for a rapidly fatal temperature of 49°C. [120·2°F.] in the dark section. At very high temperatures, they exhibited a negative

reaction even to the diffused daylight of the laboratory.

A negative reaction to light was also shown at high temperatures by Stomoxys calcitrans, L., although it was not so strong as that of G. morsitans. On the other hand, Musca domestica vicina, Macq., displayed a far greater ability to find a comfortable temperature by the process of trial and error, independently of the light conditions. The difference in reaction between Glossina and Musca was, however, definite; if the temperature of both sections of the cage was raised evenly above the lethal point, most of the tsetse flies died in the dark section and most of the house-flies in the light one; with Stomoxys a more or less even distribution in the two sections was obtained. Under natural conditions, temperature in the shade is always lower than in the sun, and the reaction of G. morsitans described above obviously guides the fly from the dangerous heat of the sun's rays to a cooler position in the shade. The combination of direct sunlight and a rapidly rising temperature induces a very quick response. In the forest, the temperature in the shade is generally below that necessary to induce a negative reaction to light, and at the same time the heat of the sun's rays is commonly sufficiently high quickly to raise the body temperature of the fly above the critical temperature if the fly settles. In these circumstances an active fly is likely to alternate frequently its movements into and out of shade. On the other hand, during the heat of the day in the late dry season, the temperature in the shade of the savannah forest not infrequently approaches, and at low altitudes may even exceed, 100°F. Under these conditions the flies will not move from the shade to a moving man or vehicle. In the case of an insect such as the tsetse fly, a negative reaction to light will necessarily be exhibited in the field as a positive reaction towards conspicuous objects yielding shade, and this has a bearing on the attraction exercised by stationary traps that present actual shade or dark-coloured screens that look like shade.

NASH (T. A. M.). Abdominal Markings in the Genus Glossina (Diptera), in relation to Habitat.—Proc. zool. Soc. Lond. (A) 107 pt. 3 pp. 351-352. London, September 1937.

The author briefly discusses observations on the abdominal markings of *Glossina* made during ten years of ecological research on tsetse flies in East and West Africa. He has found that there is a tendency both within a species and among different species for these markings to become lighter in colour as the vegetation of the habitat becomes thinner.

VAN HOOF (L.), HENRARD (C.) & PEEL (E.). Action de repas médicamenteux sur l'évolution des trypanosomes pathogènes chez la Glossina palpalis.—Ann. Soc. belge Méd. trop. 17 no. 3 pp. 385-440, 19 refs. Brussels, September 1937.

A detailed account is given of experiments carried out at Leopoldville to determine whether the ingestion by Glossina palpalis, R.-D., of blood from an animal that has been treated for the control of trypanosomiasis affects the development of trypanosomes within the fly. Experiments in which single flies known to be infected were fed on the blood of animals treated with tryponarsyl or germanine indicated that Trypanosoma gambiense is not destroyed in any stage of development. The same result was obtained in single experiments with neosalvarsan and antimoniated Sdt. 411 Bayer. On the other hand, a high proportion of the flies that had imbibed treated blood, although they were apparently infective, did not transmit the trypanosome to guineapigs. The unusual length of the incubation period in guineapigs bitten by flies treated in this way confirms the suggestion that treated blood, although it has no effect on the morphology of T. gambiense, reacts on its virulence. In experiments in which treated blood was ingested prior to the infecting meal, no effect on the development of the trypanosome was observed, except when the dose of the drug was large. Experiments in which batches of flies fed on infected animals took meals of treated blood during the course of development of the trypanosomes or at the time when they were presumed to have reached maturity showed that the numbers of flies that became infected were not reduced, but that the transmission to animals subsequently bitten was reduced or retarded. Similar results were obtained in the case of T. brucei, but meals of treated blood appeared to have no effect on T. congolense. On the other hand, blood treated with germanine greatly decreased the number of flies that became infected with T. vivax (cazalboui).

VAN HOOF (L.), HENRARD (C.) & PEEL (E.). L'infection proventriculaire permet-elle de pronostiquer à coup sûr l'invasion ultérieure des glandes salivaires de Glossina palpalis par Trypanosoma gambiense?—Ann. Soc. belge Méd. trop. 17 no. 3 pp. 441-459, 12 refs. Brussels, September 1937.

The question whether the invasion of the proventriculus of *Glossina* by trypanosomes is an indication that the fly will sooner or later become infective has been disputed, and the observations and experiments here described are put forward in an endeavour to settle it.

In experiments with Glossina palpalis, R.-D., and a non-transmissible strain of Trypanosoma gambiense, 1,428 flies were used; 40 showed gut infections and 8 of these infection of the proventriculus. With a slightly transmissible strain, 1,380 flies were used; 20 showed gut infections, 31 infections of the proventriculus, and 3 infections of the salivary glands. With an easily transmissible strain, 245 flies were used; 33 showed gut infections, 10 infections of the proventriculus.

and 7 infections of the salivary glands.

Thus, even in strains that have lost the ability to complete their cyclical development, the long, thin forms characteristic of the proventriculus infection may be produced. The number of cases in which development was inhibited after the trypanosomes had become established in the gut indicates that invasion of the proventriculus is Negative results were obtained when guineapigs were injected either with the infected proventriculus of flies infected with transmissible strains of the trypanosome or with the proboscis containing trypanosomes from flies in which the proventriculus was infected but the salivary glands were not. Cases in the authors' experiments in which infected flies showed trypanosomes in the salivary glands but not in the proventriculus are reviewed. They consider that infection of the salivary glands of flies in the absence of infection in other parts of the body is more probably due to the spontaneous disappearance of the trypanosomes than to direct invasion of the salivary glands without previous development in the intestine [cf. R.A.E., B 23 265]. They point out that if direct invasion took place, it would be logical to suppose that the developmental cycle would be completed in a much shorter time than in any case that they have observed. They conclude that infection of the proventriculus does not necessarily imply the subsequent invasion of the salivary glands nor the transmissibility of the strain of trypanosome. It does, however, mark a particular stage in the development of the trypanosome, for there are produced long, thin forms that seem to be meant to invade the salivary glands. The production of these special forms also supports the theory that the normal mode of infection of the salivary glands of Glossina by T. gambiense necessitates a previous development in the intestine.

Corson (J. F.). The Use of isolated infective Flies in Transmission Experiments with Glossina morsitans and Trypanosoma rhodesiense.

—J. trop. Med. Hyg. 40 no. 20 pp. 248–249, 4 refs. London, 15th October 1937.

From his experience of experiments on the transmission of *Trypanosoma rhodesiense* by *Glossina morsitans*, Westw., the author discusses the advantages of using isolated infected flies as a means of avoiding some of the unknown factors involved when batches of flies are

employed. He points out, however, that the method may be impracticable if large numbers of flies are used and consequently large numbers of experimental animals are needed for their isolation. He suggests that a more exact knowledge would be acquired if the work were carried out not only with isolated flies but also with strains of the parasite obtained by infection with single trypanosomes.

RODHAIN (J.). Notes sur Trypanosoma minasense (Chagas). Evolution du trypanosome de Saimiri chez divers arthropodes.—C. R. Soc. Biol. 126 no. 24 pp. 69–72, 1 ref. Paris, 1937.

A brief account is given of experiments in which various Arthropods were fed once on a monkey, Chrysothrix sciureus, found to be harbouring a trypanosome closely resembling Trypanosoma minasense. Among adults of Cimex lectularius, L., 50 per cent. became infected; among small nymphs, which ingest less blood, the proportion infected was less. Of 7 nymphs of Panstrongylus (Triatoma) megistus, Burm., 4 became infected. Trypanosomes were still present after 49 days in Cimex and 67 days in Panstrongylus. No infection was found in 25 nymphs of Ornithodorus moubata, Murr., or 3 adults of Pulex irritans, L.

VAN HOOF (L.), HENRARD (C.) & PEEL (E.). Sur le rôle du pore indigène comme réservoir de Trypanosoma gambiense.—C. R. Soc. Biol. 126 no. 24 pp. 72–75, 8 refs. Paris, 1937.

From experiments carried out at Leopoldville with Glossina palpalis, R.-D., and Trypanosoma gambiense, it is concluded that native pigs may constitute an ideal reservoir for this trypanosome, which gives rise to no symptoms in them. There is a striking discrepancy between the rarity of the trypanosomes in the peripheral blood of the pig and the comparative ease with which they infect the fly and complete their cyclical development in it, and it is suggested that pig-blood may be a favourable medium for the development of the few trypanosomes ingested by the fly. The pig may remain infective for at least a year.

CUTHBERTSON (A.). Biological Notes on Some Diptera in Southern Rhodesia.—Proc. Rhod. Sci. Ass. 35 pt. 1 pp. 16-34. Salisbury, S. Rhod., August 1937.

The flies dealt with include various Muscids, Calliphorids, Sarcophagids and Hippoboscids.

Lamborn (W. A.). Annual Report of the Medical Entomologist for 1936.—Annu. med. sanit. Rep. Nyasaland 1936 pp. 43-44. Zomba, 1937.

Brief notes are given on the work that has been carried out by the author in Nyasaland during 1936. The results of a study on the transmission of leprosy by *Musca sorbens*, Wied., have already been noticed from a more detailed source [R.A.E., B 25 154]. In further work to ascertain whether Spirochaeta (Treponema) pertenuis multiplies in this fly [cf. 25 18], 45 reared flies were fed on a yaw in the infective stage, one or two were dissected every day, and each part of the alimentary canal was stained and examined separately; the results were negative. Attempts to infect native volunteers by applying

the guts of the flies and their contents day after day to freshly made scratches also gave negative results. From tsetse-fly surveys in the Dowa and Fort Manning Districts of the Northern Province, it was concluded that the situation continues to improve; except for one small focus of Glossina [morsitans, Westw.], there seems to be no fly south of the former barrier line. In May, several weeks after the cessation of the rains, Aëdes aegypti, L., was found breeding abundantly in a water-cooler on the verandah of the only European house at the Chileka aerodrome, and larvae of the same species hatched in numbers a few hours after débris taken from rot-holes in trees near the aerodrome at Zomba in May and in August had been thrown into water.

ROBIC (J.). Les caractères de la peste à Madagascar.—Ann. Méd. Pharm. colon. 35 no. 2 pp. 305-358. Paris, 1937.

The subject of plague in Madagascar is comprehensively reviewed. After outlining the history of its introduction, the author discusses the types of plague, the conditions under which they appear and their frequency, the epidemiology of the disease, the mortality it causes, and the measures taken to eradicate foci. He then gives accounts of the domestic rats and murine plague, wild rodents and insectivores and the possibility of the existence among them in Madagascar of "sylvatic" plague, such as occurs in South Africa [cf. R.A.E., B 17 70], and fleas and their habitats apart from their hosts. Finally, he deals with the virulence of various strains of the causal organism that have been isolated, indicates the means that may be used to destroy rats and fleas in houses, and surveys the results obtained from vaccination and treatment.

Martial (J. E.). La prophylaxie biologique du paludisme et de la fièvre jaune.—Ann. Méd. Pharm. colon. 35 no. 2 pp. 358-374, 19 refs. Paris, 1937.

The author reviews from the literature biological methods that have been used in the control of malaria and yellow fever in various parts of the world. They comprise the shading of breeding places of certain Anophelines, periodic flushing and the employment of larvivorous fish against the larvae of Anophelines and Aëdes aegypti, L., and the use of animal deviation (zooprophylaxis) as a means of protecting man from the attacks of Anopheline adults.

BARANOV (N.). Die Kolumbatscher Mücke in Jugoslawien im Jahre 1937. [Simulium columbaczense in Jugoslavia in 1937.]—Arch. Tierheilk. 72 no. 2 pp. 158–164, 1 map. Berlin, 1937.

In this paper, the author records observations in 1937 on Simulium columbaczense, Schönb., in Jugoslavia [cf. R.A.E., B 25 249, etc.]. The high level and low temperature of the Danube in March, April and May were unfavourable to it, as compared with 1934 when there was a very severe outbreak [cf. 24 276, etc.]. The species was observed to comprise two ecological races, which the author names litorale and profundale and of which the larvae occurred, respectively, on branches of submerged willows and in the depths of the Danube. Adults of race profundale are somewhat smaller than those of race litorale and other slight morphological differences are indicated.

Adults of race litorale emerged from 12th April to 18th May, with a break occurring between 24th April and 3rd May, when the river level rose again with an abundant flow of cold water. Adults of race profundale began to emerge in the first ten days of May, but none emerged from 24th to 29th May, owing to the cooling of the water. In June, S, columbaczense was abundant and troublesome, individuals from the depths of the Danube being the more aggressive. They attacked man freely in the village of Golubac, and at sunset cattle were covered with the flies, estimated at 3,000-5,000 per animal. The effects of the bites on man, which are described, were more pronounced in the case of race profundale. This abundance of S. columbaczense is attributed to the fact that the small sturgeon, Acipenser ruthenus, which normally destroys large numbers of the larvae in the Danube in April and May, left the river for the flooded meadows. Adult emergence of the Simuliid took place only on very favourable days, and on these the males were common near the Danube, but soon died. Females lived for a month or more. Among the adults bred from pupae taken from deep water, females were 4–5 times as numerous as males. The longevity of the females and the absence of mature eggs in those participating in a distant migration [cf. 25 249], all of which apparently belong to race profundale, indicate that the females are not fertilised immediately after emergence, but much later by younger males. As males are absent in the invaded territory, the migrating females cannot breed there.

The following possibilities of control are suggested: A close season for *Acipenser ruthenus* from March to June, when it feeds almost exclusively on the larvae, about 2,000 having been found in a small, 10-inch fish; the use of some insecticide to destroy the newly emerged adults as they appear at the surface of the water; the application of a poisoned bait-spray to the bushes and trees on the banks; and the destruction of the eggs that are stranded along the banks when the river falls. Further investigations are desirable, although reports of

deaths of cattle due to this Simuliid have become infrequent.

OSWALD (B.). Kratak prikaz o razvojnom ciklu važnijih protozoa u krpeljima. [Short Account of the Life-cycle of some important Protozoa in Ticks.]—Yugoslav. vet. J. 1937 no. 10 reprint 11 pp., 1 fig., 2 fldg tables, 20 refs. Belgrade, 1937. (With a Summary in English.)

In view of the severe losses caused among domestic animals and fowls in Jugoslavia by protozoan diseases [cf. R.A.E., B 26 7], data from the literature on the development in ticks of piroplasms, Anaplasma, spirochaetes and rickettsiae are briefly reviewed. A table shows the chief species of ticks responsible for the transmission of protozoan diseases in animals, the number of hosts required by each to complete development, the diseases it transmits, its poisonous properties, the countries in which it occurs and its hosts.

SEN (S. K.). The Occurrence of Spinose Ear Tick (Ornithodorus megnini Dugès) in India.—Indian J. vet. Sci. 7 pt. 3 pp. 213-218, 2 pls., 7 refs. Delhi, September 1937.

After the receipt of three further batches [cf. R.A.E., B 25 122] of Ornithodorus megnini, Dugès, from horses in India, investigations were made by the Army Veterinary Department and the tick was

discovered at three stations (in Bombay Presidency, Central India and the Central Provinces), the percentages of horses infested being 8·8, 7·3 and 13, respectively. The tick may have been introduced on mules from America, or on stock from South Africa; it is reported to be unknown in Australia, from which country many horses are imported. Since it appears to be fairly widely distributed in India and is known to be an important pest of domestic animals, notes for the use of veterinary workers are given on its world distribution, its morphology and bionomics, and the method of treating infestations by syringing the ear of the animal with a mixture of 2 parts pine tar and 1 part cottonseed oil [cf. 7 93].

SEN (S. K.) & ABDUS SALAM. Experiments on the Transmission of Rinderpest through the Agency of Stomoxys calcitrans Linn.—
Indian J. vet. Sci. 7 pt. 3 pp. 219–224, 1 fig., 4 refs. Delhi, September 1937.

An account is given of further experiments carried out at Mukteswar. United Provinces, on the possibility of transmitting rinderpest by the interrupted feeding of Stomoxys calcitrans, L. [cf. R.A.E., B 24 134]. Flies that had partly engorged on infected bulls were allowed to complete their feed on a healthy animal after intervals that varied from 15 to 45 minutes. Although the experimental animal received 1,081 bites over a period of 29 days, it remained normal throughout an observation period of 45 days from the time it received the last bite. It was then inoculated with infected blood and died with typical symptoms of rinderpest. In order to feed a number of flies singly but simultaneously, each was placed in a small glass tube (1 by 4 inches) the mouth of which was covered with mosquito netting having about 18 meshes to the linear inch. The tubes were inserted into holes in a cork sheet and the whole inverted over a shaved area on the abdomen of the animal, the sheet being curved so that each tube touched the animal. Ten tubes could be inserted into a sheet 7 by 3½ inches, and two sheets could be manipulated by one man simultaneously.

SEN (P.). The relative Prevalence of Anophelines in Houses and Cattle-sheds in Deltaic Bengal.—Rec. Malar. Surv. India 7 no. 2-3 pp. 147-153, 2 charts, 1 ref. Calcutta, 1937.

Extensive searches for adult Anophelines were carried out in a group of villages on the banks of the River Hooghly downstream from Calcutta during the period from August 1933 to July 1934 to determine their relative incidence in dwellings and cattle-sheds, and the results are tabulated and briefly discussed in this paper. The Anophelines were always much more abundant in cattle-sheds than in dwellings close by. No species was absolutely restricted to either type of daytime resting place. Females were greatly in excess of males; the proportion of males was usually less than 10 per cent. of the total catch in a year, although in the case of A. subpictus, Grassi, A. vagus, Dön., and A. sundaicus, Rdnw., it was higher.

Senior White (R.). The Maxillary Index of the Indian Anophelines.—

Rec. Malar. Surv. India 7 no. 2-3 pp. 155-177, 52 refs. Calcutta, 1937.

A summary, with an annotated bibliography, of published work on the maxillary index of *Anopheles* throughout the world is given, and it is shown that evidence continues to accumulate in support of Roubaud's original hypothesis that mosquitos with an index of 14 or less usually feed on man and those with one of 14-15 on cattle [cf. R.A.E., B 10 53]. A study of the maxillary indices of the Anophelines of India, chiefly from the east-central region, was begun by the author in 1933 and continued for almost 4 years. The magnification used and the method of counting the teeth are discussed. Taking into account the probable error for different numbers of maxillae counted and the fact that no difference is significant unless it is three times the probable error, the author has, wherever possible, counted 200, since this figure has a standard error of +0.3, making a difference of 1 statistically significant. Trensz has calculated that it would be necessary to examine 10,000 maxillae to obtain an index significant to one place of decimals. It was impossible to collect a sufficient number of adults of certain species that could be bred in numbers from larvae; preliminary observations on Anopheles subpictus, Grassi, showed that, although the index of reared and wild specimens was the same, the dispersion about the mean was different. When, however, the adults used were bred from pupae collected from natural breeding places and due to transform within 24 hours, their maxillary indices differed from those of adults caught in nature only within chance limits and the two could therefore be considered comparable. Although other experiments with A. subpictus indicated that there is a seasonal cycle in the maxillary index, with peaks in August and February, which should prevent its being calculated from specimens taken at different seasons, in practice it was impossible to take account of this, at least in the case of some of the rarer species, since it was necessary to collect them wherever they were available in order to obtain the necessary number of specimens. To determine whether it was safe to work out the maxillary indices for species in a region stretching over 5 degrees of latitude and 8 degrees of longitude, the indices were worked out for A. subpictus caught in two areas 200 miles apart representing the extremes of breeding conditions encountered in this region of India. Any differences were found to be due to chance, so that specimens collected from any part of the area may safely be used in calculating the indices. There is, however, considerable evidence from the work of others that significant differences may be found between the indices for the same species in regions more widely separated.

The results of counts on 22 species are shown in a table, the index being computed by dividing the total number of teeth counted by the number of maxillae examined and shown to one place of decimals (in which case the last figure is insignificant) and as the nearest whole number. Of the seven species with a whole-number index of 12, six have been found naturally infected with malaria parasites in the area investigated and the seventh has been found naturally infected in another part of India. Of the ten with an index of 13, four have been found infected with oöcysts, two others are known to be vectors in other parts of India, and a third has been found with a gut infection in another area. In the group with an index of 14 there is one efficient vector, A. sundaicus, Rdnw., and two non-vectors; the anomalous position of A. sundaicus has also been observed in the Netherlands Indies [cf. 24 90]. The two species with indices of 15 and 16, respectively, are not vectors. Thus the Anopheline vectors in India all belong to Roubaud's paucidentate group, but as the group also

contains a large number of non-vectors, the suggestion that, in the study of an unknown fauna, the working out of the maxillary indices is of more importance than the discovery of infected individuals cannot be seriously considered.

Finally the author compares the indices obtained in India with those obtained by other workers for the same species in Indo-China and the Netherlands Indies.

RAO (B. A.) & SWEET (W. C.). Paris Green and Paddy.—Rec. Malar. Surv. India 7 no. 2-3 pp. 185-189, 1 ref. Calcutta, 1937.

In 1934-36 experiments were carried out in Mysore in which the vield of grain, straw and chaff from rice plants in plots dusted with a mixture of Paris green, road dust and wood ash in the proportions of 1:55:44 (the quantities generally used for the control of Anopheline larvae) was compared with that of untreated plots. The results gave no indication that Paris green decreased the vield of grain and straw or increased the yield of chaff, or that it was necessary to cease dusting during the period when the rice was in flower [cf. R.A.E., B 23 217].

SWEET (W. C.). A Study of Village Malaria in Mysore State.—Rec. Malar. Surv. India 7 no. 2-3 pp. 191-207, 1 map, 2 graphs., 6 refs. Calcutta, 1937.

The following is the author's summary: A study of malaria in three villages of Mysore State, lying within a circle with a radius of under one mile, was made in 1935. The parasite indices of children between 0 and 14 years of age were 6.9, 41.7 and 16.4 per cent. with corresponding spleen indices of 21·0, 73·7 and 15·0 per cent. The catch of dangerous adult Anophelines [cf. R.A.E., B 23 17], the majority being Anopheles culicifacies, Giles, in selected catching stations was approximately equal in the first two villages, but considerably lower

in the third village.

Relative catches of infected and non-infected A. culicifacies in human dwellings, combined human and cattle houses, and in separate cattlesheds suggested the possibility that A. culicifacies was not strongly attracted to human blood meals and that houses combined with cattlesheds offered the greatest opportunities for malaria transmission by this species. The occurrence of malaria infection in A. culicifacies was about equal in all three villages, and infected specimens were as common in separate cattle-sheds as in combined human and animal houses. It seems possible that one village was protected from severe malaria by the comparative absence of combined human and animal dwellings, and that another village usually enjoyed a low malarial incidence owing to a comparatively low density of A. culicifacies.

GORE (R. N.). An improved Feather-duster Mosquito Trap.—Rec. Malar. Surv. India 7 no. 2-3 pp. 209-211, 6 figs. Calcutta, 1937.

In this modified form of feather-duster mosquito trap $\lceil cf. R.A.E.$, B 22 17], the feather duster is placed head downwards in an empty kerosene tin with the top removed. When the mosquitos are to be collected in the morning, a cloth is placed over the mouth of the tin and the duster carefully withdrawn from beneath it; a closely fitting lid is then put on the tin and the cloth is removed. Methods that may be used to destroy the collected mosquitos are briefly mentioned.

NIOGI (S. K.) & KHAN (Bhupendra Mohan). Winter Malaria Infection in the Bengal Dooars. Abstract.—Rec. Malar. Surv. India 7 no. 2-3 pp. 213-219, 3 refs. Calcutta, 1937.

Investigations, made chiefly to determine the seasonal prevalence of Anophelines infected with malaria parasites, were carried out from 1930 to 1935 on a group of tea estates in the Bengal Duars. Adults were collected once a week from human habitations and a large number were subsequently dissected; the results are shown in tables. Anopheles minimus, Theo., was the most prevalent species (10,044), followed by A. vagus, Dön. (2,086) and A. maculatus, Theo. (1,553). Infected females were found in every month of the year; A. minimus was the chief vector, parasites being present in 513 out of the 8,385 specimens dissected in the course of the six years. Two specimens of A. philippinensis, Ludl., and one each of A. culicifacies, Giles, and A. annularis, Wulp, also harboured parasites. From a spleen and parasite survey among infants born during the period from November 1935 to February 1936, definite evidence was obtained that malaria transmission occurs during the winter months.

Tulloch (G. S.). The Mosquitoes of Puerto Rico.—J. Agric. Univ. P. Rico 21 no. 2 pp. 137–167, 8 figs., 1 map, 26 refs. Rio Piedras, P.R., July 1937.

Brief notes are given on the breeding places, habits, abundance and distribution of the 34 species of mosquitos taken in the course of investigations in Porto Rico between 5th July 1935 and 1st June 1936, together with keys to the adults and larvae. They include all except two of the 25 species previously recorded from the island, a list of which is given. The species of Anopheles comprised the three already noticed [R.A.E., B 18 231] and A. crucians, Wied., a single larva of which was taken in brackish water in a hoof print.

PEUS (F.). Ermittlungen über die Stechmücken-Fauna von Potsdam als Grundlage für die Stechmücken-Bekämpfung. [Data on the Mosquito Fauna of Potsdam as a Basis for Mosquito Control.]—

Z. hyg. Zool. SchädlBekämpf. 29 no. 10 pp. 280-288. Berlin, 1937.

This is part of a report made to the authorities of the city of Potsdam on mosquitos causing annoyance there and on the possibilities of controlling them. Particulars are given of the species and breeding places found. Species of Aëdes were responsible for the trouble, Culex pipiens, L., and Theobaldia annulata, Schr., being very much less important. Anopheles maculipennis, Mg., was not abundant, was free from malaria parasites and preferred stabled cattle to man.

Watson (G. I.). Some Observations on Mosquito Larvae dying in Anti-malaria Oils and other Substances.—Ann. trop. Med. Parasit. 31 no. 3 pp. 417–426, 12 refs. Liverpool, 22nd · October 1937.

Some observations are recorded on the behaviour of larvae of *Anopheles maculipennis*, Mg., and *Culex pipiens*, L., when placed in contact with oils, Paris green and solutions of naphthalene, and when partly or completely asphyxiated mechanically. When certain oils

enter the breathing tubes, the heart muscle is disturbed in its rhythm, and sometimes rapidly stopped; other oils do not produce these effects. It is suggested that the killing power of an oil might be more accurately measured by determining the interval between the entry of the oil into the breathing tubes and the moment when the heart muscle finally ceases to contract, rather than that between the application of the oil to the water and the moment when the larvae either cease to react to touch or are unable to rise to the air surface, since, under certain conditions at least, it would appear that larvae are capable of reviving after they have reached either of these states, whereas no larva in which the heart has been quite stopped by a toxic oil has shown any signs of recovering. It is pointed out that further work is needed on the property of stickiness in an anti-malarial oil, that is, its power of adhering in droplets to the exterior of larvae and to grasses, stones, etc., at the surface of the water. This property might enhance the value of a toxic oil that is sprayed along the edges of a stream, since it might keep more oil for a longer time around vegetation at the sides, where stream-breeding larvae are usually found, and might also prevent oviposition in these situations.

BLACKLOCK (D. B.). Screencloth for Houses in the Tropics.—Ann. trop. Med. Parasit. 31 no. 3 p. 447, 2 refs. Liverpool, 22nd October 1937.

It has recently been reported from the Gambia that screencloth with 14 meshes to the linear inch of wire of no. 30 Imperial Standard Gauge installed in a hospital does not exclude certain Anophelines, which may possibly be *Anopheles funestus*, Giles. From experiments, R. M. Gordon concludes that "a certain proportion of *A. funestus* and of *Stegomyia* are capable of passing through this gauze." Thus it is clearly unsafe to use this larger mesh [cf. R.A.E., B 23 230; 24 273] without experimental proof of its efficiency in each locality.

HUGHES (A. W. McK.). The Bed-bug. Its Habits and Life-history and how to deal with it.—Econ. Ser. Brit. Mus. (Nat. Hist.), no. 5 (4th edn), 19 pp., 1 col. pl., 7 figs. London, 1937. Price 6d.

The information in the previous edition of this pamphlet on the bionomics and control of *Cimex lectularius*, L. [R.A.E., B **21** 75] has been brought up to date by the inclusion of the results of recent studies [cf. **22** 131; **25** 177].

PAPERS NOTICED BY TITLE ONLY.

Patton (W. S.). Studies on the Higher Diptera of Medical and Veterinary Importance. Illustrations of the Terminalia of Cobboldia elephantis Steel, C. [Rodhainomyia] chrysidiformis Rodhain and Bequaert and Ruttenia loxodontis Rodhain.—Ann. trop. Med. Parasit. 31 no. 3 pp. 341–349, 7 figs., 3 refs. Liverpool, 22nd October 1937.

- Patton (W. S.). Studies on the Higher Diptera of Medical and Veterinary Importance. Illustrations of the Terminalia of some Species of Gasterophilus [Gastrophilus haemorrhoidalis, L., G. flavipes, Ol., G. nasalis, L., and G. pecorum, F.].—Ann. trop. Med. Parasit. 31 no. 3 pp. 351–359, 7 figs., 2 refs. Liverpool, 22nd October 1937.
- PAWAN (J. L.). Functions of the Oesophageal Diverticula of Stegomyia [Aëdes] aegypti and Anopheles tarsimaculatus.—Ann. trop. Med. Parasit. 31 no. 3 pp. 379–382, 1 pl., 8 refs. Liverpool, 22nd October 1937.
- Evans (A. M.) & Leeson (H. S.). Notes on Variation in Anopheles rivulorum Leeson in East Africa, with Description of a new Variety [garnhamellus].—Ann. trop. Med. Parasit. 31 no. 3 pp. 383–386, 1 fig., 3 refs. Liverpool, 22nd October 1937.
- Swellengrebel (N. H.). Malaria in the Netherlands Indies [brief summary of history and position].—Bull. colon. Inst. Amst. 1 no. 1 pp. 37-45. Amsterdam, November 1937.
- ROZEBOOM (L. E.). The Egg of Anopheles pseudopunctipennis in Panama.—J. Parasit. 23 no. 5 pp. 538–539, 1 fig. Baltimore, Md., October 1937.
- [Shtakel'Berg (A. A.).] Штанельберг (A. A.). Faune de l'URSS. Insectes Diptères. Vol. III, no. 4. Fam. Culicidae (Subfam. Culicinae). [In Russian.]—Inst. zool. Acad. Sci. URSS. N.S. no. 11, x + 258 pp., 147 figs., 1 fldg. table. Moscow, 1937. Price 10 rub.; binding 2 rub. (With a Summary in German.)
- BARANOV (N.). **K poznavanju golubaçke muşice III.** [Contribution to the Knowledge of *Simulium columbaczense*, Schönb., in Jugoslavia.]—*Vet. Arhiv* **6** pts. 3–4 pp. 137–220, 1 map, 3 graphs. Zagreb, 1936. (With a Summary in Russian.) [*Cf. R.A.E.*, **B 24** 276.]
- MACFIE (J. W. S.). Ceratopogonidae from Trinidad [including 3 new species].—Ann. Mag. nat. Hist. (10) 20 no. 115 pp. 1–18, 6 figs. London, July 1937.
- Bequaert (J.). Triceratomyia, a new South American Genus [for T. macintyrei, sp. n., from Ecuador] of Pangoniinae (Diptera, Tabanidae).—Rev. Ent. 7 fasc. 4 pp. 350-353, 2 figs. Rio de Janeiro, 11th October 1937.
- Fuller (M. E.). Notes on the Biology of Tabanus froggatti, T. gentilis, T. neobasalis (Diptera) [in Australia].—Proc. Linn. Soc. N.S.W. 62 pt. 3-4 pp. 217-229, 1 pl., 13 figs., 10 refs. Sydney, 15th September 1937.
- Bequaert (J.). Notes on Hippoboscidae. 5. The American Species of Lipoptena.—Bull. Brooklyn ent. Soc. 32 no. 3 pp. 91–101. Lancaster, Pa, June 1937.
- JORDAN (K.). Some [5] new African Siphonaptera.—Novit. zool. 40 no. 3 pp. 329–332, 8 figs. Tring, 31st December 1937.

TZORTZAKIS (N.) & PAPADAKIS (G.). La paralysie à tiques chez l'homme et chez les animaux domestiques.-3rd int. Cong. comp. Path. 2 pp. 449-452. Athens, 1936. [Recd. November 1937.]

An account is given of observations on tick paralysis made on the islands of Crete and Tinos [cf. R.A.E., B 12 125]. Only sheep and goats were observed to be attacked, young animals suffering most severely. Cases occur between the time of the first rains at the end of October and the end of March; cold, wet weather seems to be the most favourable. Ticks are most prevalent in mountainous, uncultivated areas covered with bushes. Outbreaks occur once in three years, and the disease is almost non-existent in the interim. The species of ticks concerned were Ixodes ricinus, L., and Haemaphysalis cinnabarina punctata, C. & F.; Hyalomma savignyi, Gerv. (aegyptium, auct.) was only rarely observed. The females attach themselves at the rate of 30-120 per animal, chiefly to the skin of the head (particularly at the base of the ears), neck and withers. They engorge and 12-15 days later, after pairing, they drop to the ground. The local reaction at the site of attachment and the symptoms and effects of the disease are described. The authors have observed no case in man, but have received a report of an instance in which a child bitten by an example of I. ricinus showed general malaise, but no paralysis, and recovered when the tick was removed.

Patino (L.), Afanador (A.) & Paul (J. H.). A Spotted Fever in Tobia, Colombia.—Amer. J. trop. Med. 17 no. 5 pp. 639-653, 10 refs. Baltimore, Md, September 1937.

An account is given of an epidemic disease with a high mortality, observed in a strictly limited rural area in Colombia. It is a febrile infection of the typhus group, characterised by an exanthematic eruption and resembling Rocky Mountain spotted fever in some respects. Rickettsiae were found in subinoculated laboratory animals. Inoculation into guineapigs of suspensions of Pediculus humanus, L. (corporis, DeG.) from healthy persons in the area of Tobia, Cimex hemiptera, F., from the bed of a convalescent, Rhipicephalus sanguineus, Latr., from a dog belonging to convalescents, and Amblyomma cayennense, F., from horses on one of the farms gave negative results, but positive results were obtained when guineapigs were inoculated with a suspension of P. humanus capitis, DeG., from the head of a person who had died from the disease. In addition to C. hemiptera, C. lectularius, L., and Ornithodorus venezuelensis, Brumpt, were taken in beds; for various epidemiological reasons it is thought that the vector might be found in the beds and that Ornithodorus is the one most likely to be concerned.

SOPER (F. L.). Present Day Methods for the Study and Control of Yellow Fever. - Amer. J. trop. Med. 17 no. 5 pp. 655-676, 3 refs. Baltimore, Md, September 1937.

After discussing the use in the field of immunity surveys based on the mouse-protection test and of viscerotomy (post-mortem removal of liver tissue) for discovering the past extent and the present occurrence of yellow fever, the author gives an account of means by which the work of controlling the breeding of Aëdes aegypti, L., has been rendered more efficient and less costly. It has long been known that it is not necessary to exterminate this mosquito from a locality in order to prevent the occurrence of urban yellow fever, but the critical point below which transmission will not occur is not constant for all places, or for all times at the same place; it varies according to many interrelated factors, such as the size of the community, the percentage of the population that is immune, and the introduction of non-immune and of infective persons from other areas. Experience over many years showed that the critical index was generally reached when careful house-to-house inspection revealed larvae in not more than 5 per cent. of the premises visited. Although it was relatively easy to obtain such an index, its reduction to a figure approaching zero was prohibitive in cost. About 1928, D. B. Wilson, working in Parahyba, Brazil, found that there is a critical breeding index below which inspectors continue to find each week a few foci containing the earlier larval instars, but practically never the later ones. This suggested the existence of well-hidden "mother foci," but the location and elimination of these was not completely successful until it was found that catches of adults made by hand were a most sensitive indicator of the presence and density of this species in places where the index was already low. Careful analysis of the distribution of adults by houses, giving special attention to the relative density of the two sexes, in most cases enabled hidden breeding places to be located within 25-30 yards. By using this method, the breeding indices in cities and towns in Brazil have been reduced at a reasonable cost to less than 0.1 per cent. and have remained at this low level during several years. Once such an index has been reached, it can be maintained with less expense than an index of 1-5 per cent., and, once it has been maintained for some weeks, the interval between house visits may be increased from 1 to 2, 3 or even 4 weeks in the larger cities, and inspection may be discontinued for long periods of time without danger in smaller cities. Quarterly visits to every third house can be relied on to indicate the reappearance of A. aegypti before the critical index is reached. The reduction in the index has doubtless been aided by the practice, introduced in 1931, of applying a mixture of Diesel and fuel oils to all containers in which mosquito larvae are found; part of its value is thought to be due to the destruction of mosquito eggs by the thorough cleaning of treated vessels necessary before they can again be used in the house.

WALCOTT (A. M.), CRUZ (E.), PAOLIELLO (Adhemar) & SERAFIM, jr. (J.). An Epidemic of Urban Yellow Fever which originated from a Case contracted in the Jungle.—Amer. J. trop. Med. 17 no. 5 pp. 677–688, 2 maps, 11 refs. Baltimore, Md, September 1937.

An account is given of an outbreak of yellow fever that occurred during the period February-April 1936 in the town of Cambará, Paraná, Brazil, and is believed to have originated in an infection contracted in the jungle. The 25 urban cases all appeared in an area not more than 100 yards in diameter in a part of the town infested with Aëdes aegypti, L., in which resided a labourer who for 3 weeks prior to an attack of yellow fever had worked in the jungle about 10 miles from the town. The first urban case occurred 17 days after

the onset of fever in the labourer, an interval that allows for an incubation period of 12 days in the mosquito, an additional day or two during which the mosquitos may not have bitten, and an incubation period of 3-4 days in the patient. There was no history of yellow fever in the district prior to the occurrence of the jungle case, the disease was not recognised elsewhere in Cambará, and none of the 25 persons infected had been absent from the town during the 3 weeks prior to their illness. The epidemic subsided promptly after adequate measures for the control of the breeding of A. aegypti had been instituted. Nine timber cutters from the same area of jungle in which the labourer had worked gave histories of attacks of a disease, occurring between early February and the middle of March, that has been clinically diagnosed as yellow fever; during the incubation periods none of them visited any place where yellow fever was known to exist and they neither lived in nor visited Cambará. Surveys of blood-sucking Arthropods were made in the town and in the jungle. In and near the jungle they become a pest during the warm season; no examples of A. aegypti were found there, but among the mosquitos collected were several other species of Aëdes, including A. scapularis, Rond., a species of Haemagogus, Psorophora ferox, Humb., and several other species of the same genus.

Woke (P. A.). Comparative Effects of the Blood of different Species of Vertebrates on Egg-production of Aëdes aegypti Linn.—Amer. J. trop. Med. 17 no. 5 pp. 729-745, 8 refs. Baltimore, Md, September 1937.

The experiments described were carried out to determine whether there are significant differences in the nutritive values of the blood of different species of animals that may serve as hosts for Aëdes aegypti, L. [cf. R.A.Ē., B 25 236], using the number of eggs laid per mg. blood ingested as the basis of comparison. The technique used is described in detail. It is concluded that significantly greater numbers of eggs are produced on the blood of turtle, frog, canary, rabbit or guineapig than on the blood of man or monkey, and significantly greater numbers of eggs on the blood of guineapig or frog than on the blood of canary. The difference in the effect of the blood of man and of monkey is probably not significant.

Weber (N. A.). The Sting of an Ant.—Amer. J. trop. Med. 17 no. 5 pp. 765-768, 1 fig. Baltimore, Md, September 1937.

While working in British Guiana, the author was stung by an ant, Paraponera clavata, F.; he here records the effect of the poison, which was so virulent that it would seem to be more powerful than formic acid.

KNIPLING (E. F.) & RAINWATER (H. T.). Species and Incidence of Dipterous Larvae concerned in Wound Myiasis.—J. Parasit. 23 no. 5 pp. 451-455, 4 refs. Baltimore, Md, October 1937.

Information available in the literature on the species of flies implicated in the production of myiasis in the United States and the comparative incidence of each is limited. For this reason the authors record the results of determinations of 901 batches of larvae collected from wounds in man and animals in the south-eastern, middle-western

and south-western sections between June 1935 and April 1936. The following is taken from their summary: Cochliomyia hominivorax, Coq. (americana, Cush. & Patt.) was involved in approximately 90 per cent. of the total number of cases of myiasis, and secondary species as a group were involved in approximately 13 per cent. The following species or genera, given in order of decreasing incidence, were taken from animals: Cochliomyia hominivorax, Phormia regina, Mg., Lucilia spp., C. macellaria, F., Sarcophaga spp., Calliphora spp., Musca domestica, L., Cynomyia cadaverina, R.-D., Stomoxys calcitrans, L., and Hermetia spp. L. sericala, Mg., was the most common species of Lucilia; L. coeruleiviridis, Macq., and L. cluvia, Wlk., which were also concerned, do not appear to have previously been reported from wounds in animals. Sarcophaga bullata, Park., was the most common Sarcophagid. A host list is given for C. hominivorax and for the secondary species as a group; the latter apparently attack a greater variety of hosts than the former.

LARSON (C. L.). The Tick Parasite Ixodiphagus texanus in Nymphs and
 Larvae of Haemaphysalis leporis-palustris in Minnesota.—J.
 Parasit. 23 no. 5 pp. 496-498, 11 refs. Baltimore, Md, October 1937.

The author records the recovery of the parasite, Ixodiphagus texanus, How., from nymphs and larvae of Haemaphysalis leporispalustris, Pack., taken from hares, a rabbit and a grouse in Minnesota during 1934 and 1935. This would appear to be the first time that parasites have been observed to emerge from larval ticks taken in nature. This Encyrtid has previously been found only in Texas and Idaho, where climatic conditions are not so adverse.

Causey (O. R.). New Anopheline and Culicine Mosquitoes from Siam.
—J. Parasit. 23 no. 5 pp. 543-545, 1 fig. Baltimore, Md, October 1937.

In a recent paper [R.A.E., B 25 188], it was shown that whereas the mosquito fauna of Siam was quite different in the aggregate from that of any of the neighbouring countries, most of the species found had been described from Malaya, India, Indo-China, or some of the Pacific Islands. Examination of a large collection has, however, revealed several new species, of which two are described, viz., Anopheles bulkleyi, from a male bred from a larva found in a tree-hole, and Aëdes (Finlaya) hegneri, from adults of both sexes bred from larvae found in rock pools.

Stewart (J. I.). [Report of the] Veterinary Laboratory.—Rep. Dep. Anim. Hlth Gold Cst 1936-37 pp. 12-21. Accra, 1937.

Beetles that caused considerable annoyance at Pong Tamale during the rains of 1935 and 1936 by producing large blisters when crushed against the skin were identified as the Meloids, *Cylindrothorax* dusaulti, Dufour, and Psalydolytta substrigata, Lap.

Much of the information on trypanosomiasis in pigs in the Gold Coast [cf. R.A.E., B 25 61] and on the work for eradicating Glossina palpalis, R.-D., at Pong Tamale [25 221] has already been noticed. At the end of the rains in 1936 a further half mile [of the Naboggo

River] was cleared in order to prevent the percolation of flies into the

Mbuom valley.

Fly-boys were stationed at Yendi to test the efficacy of the clearing work there [cf. 25 42]. In August both G. palpalis and G. tachinoides, Westw., were reported to be numerous in the plantation, which had been allowed to become overgrown and so had become a suitable breeding ground. Vigorous clearing measures were immediately instituted, for cases of sleeping sickness had begun to appear in the town, and of 37 flies dissected, 3 were infected with Trypanosoma gambiense and 2 with unidentified trypanosomes. Both species of fly survived in the plantation throughout the dry season under conditions that are usually considered lethal. By mid-December the stream running through the middle was dry, by 10th January the last water-hole was empty and there was no water of any kind left, and by the end of January the last trace of moisture had disappeared. All low shade had been eliminated in August-October, and attempts were being made to eradicate the flies by catching. From early January to mid-February the humidities were in the neighbourhood of 30 per cent. and temperatures as high as 105°F. were recorded in March. The flies caught during the dry season were all old, as the ground during this period was too hard for successful pupation, and it is hoped that the numbers have been reduced sufficiently to prevent the revival of the focus during the wet season. A further half mile along the Kulpani was cleared at each end of the original clearing to stop flies coming to the road bridge over the river during the rains, and the plantation and the valley leading to Yendi were re-cleared.

A clearing 200 yards wide on each side of the ferry was made on the river Oti between Yendi and Zabzugu. This has interrupted the close contact between man and fly during the dry season. Observations on similar clearings in Mamprusi near Gambaga during October, when the streams are at their height, showed that in clearings 400 vards wide, flies could be caught as abundantly as in the uncleared fringing bush above and below the cleared area; the flies leave the shade and go to the road to feed on man, using the bridges as sheltering places. Such clearings are, however, of value during the dry season. Of 32 flies caught near Gambaga, 3 were infected with T. gambiense

and 2 with unidentified trypanosomes.

Lists are given of the flies caught during the year in the Pong Tamale area, in Eastern Dagomba, and in the Wa and Mamprusi Districts. In Pong Tamale they comprised 21 examples of G. palpalis and 24,610 of G. tachinoides; of these 13,765 were marked and released to ascertain if they spread far in the wet season. Only 30 were recovered, of which 8 were taken in the tops of submerged trees [cf. 25 223 at the main river and the others were caught close to the river, the furthest being a mile away. This demonstrates the efficacy of clearing, for in previous years, when it was possible for them to work their way from low shade to low shade throughout the countryside, marked flies were caught at some considerable distance from the main river. In a survey carried out in the vicinity of Accra under dry season conditions (November), no flies were caught within 8 miles, though they probably occur closer to the town during the wet season. A survey at Kumasi showed that fly was plentiful in spite of the excellent clearings that have been made in and around the town; clearings are unlikely to be effective in the forest, but a barrier of thick vegetation round the town might prove successful and should be easy to grow.

[PARAMONOV (S. Ya.).] Парамонов (С. Я.). Das Rätsel der Fliege Lucilia sericata Mg. [The Problem of L. sericata.] [In Ukrainian.] —Trav. Mus. zool. Acad. Sci. Ukr. по. 19 pp. 183–196, 132 refs. Kiev, 1937. (With Summaries in Russian and German.)

The history of the use of larvae of Lucilia sericata, Mg., and other flies for the treatment of suppurating wounds and of investigations on the causes of their healing action is reviewed [cf. R.A.E., B 23 57, etc.], and attention is drawn to the fact that L. sericata is also known to be responsible for myiasis in man and to cause severe losses of sheep in many countries. In the steppes of the Ukraine and northern Caucasus, however, it has not been found infesting sheep, though it is very abundant. This may be partly due to the effect of the dry climate [cf. 23 227], but the summers are often cold and rainy. The author points out the need for further investigations of the conditions of the environment that enable larvae of Lucilia and other blowflies to pass from necrotic to healthy tissue.

[Рокпочент (S. N.) & Polikarpova (L. I.).] Покровский (С. Н.) и Полинарпова (Л. И.). The Transportation of malarial Mosquitoes into Stalingrad and Astrakhan on local River Steamers. [In Russian.]—Med. Parasitol. 6 no. 2 pp. 224–230, 1 map, 2 figs. Moscow, 1937. (With a Summary in English.)

In the course of the last few years, aeroplane dusting with Paris green against Anopheline larvae has been carried out in the environs of the towns of Stalingrad and Astrakhan on the Lower Volga without preventing the occurrence of adult mosquitos in these towns. In 1936, passenger steamers plying between them and the villages in the delta of the Volga were periodically inspected, and it was found that considerable numbers of Anopheles maculipennis, Mg., were being transported to both towns from localities in which no dusting had been carried out. On the other hand, practically no mosquitos were found on steamers arriving from villages within the treated zone. The mosquitos, most of which were females in different stages of blood digestion, concentrated in dark corners in cabins and saloons and were more abundant on large steamers than on small ones, which are more exposed to wind and fluctuations of temperature. They had evidently entered the saloons, etc., chiefly through the windows, as their numbers were considerably reduced in August by keeping the windows shut in the evening. Steamers leaving Stalingrad or Astrakhan were not infested.

[Yakushev (M. R.).] Якушев (M. P.). Anti-larval Measures against malarial Mosquitoes in Mill Ponds. [In Russian.]—Med. Parasitol. 6 no. 2 pp. 231–238. Moscow, 1937. (With a Summary in English.)

In the Western Province of European Russia, mill-ponds provide favourable breeding-places for Anophelines, especially as they are often overgrown with submerged aquatic vegetation, which frequently forms a carpet below the surface [cf. R.A.E., B 23 107]. The types of vegetation occurring in different parts of the ponds are discussed, and an account is given of observations on the effect of draining three ponds in the second half of June 1935. The ponds were kept empty for 12–15 days and the larvae in them were destroyed. The

carpet of vegetation was eliminated, but the mosquitos bred in the ponds again after they had been filled. An experiment in August to ascertain what happened to the larvae when a pond was drained showed that some of them were carried away by the current of water with small clumps of filamentous algae, but the vast majority remained on the bottom of the drained pond. Mature larvae were able to survive on the damp surface of the bottom for up to 4 days, and the pupae probably gave rise to adults, since two mosquitos occurred in a

trap with which a section of the bottom was covered.

The author suggests that mill ponds should be drained periodically during the malaria season in cases in which the mill only works at intervals and the pond is not stocked with fish of commercial value. Keeping the pond empty for 8-9 days is sufficient in dry weather, since it takes 4 days for the water to evaporate from small depressions on the bottom of the pond and 5 days for a crust to form on the mud, by which time no living larvae are found. Draining in the spring and summer should take place as soon as any larvae reach the fourth instar, to prevent pupation and possible emergence of adults. Aquatic vegetation at the bottom of the pond, which may shelter the larvae, should be destroyed, and the débris and plants that are being carried away by the current should be removed to prevent larvae from escaping with them. In autumn, the ponds should be finally filled when the mean day temperature falls to 15°C. [59°F.]. All accumulations of water harbouring Anopheline larvae in the neighbourhood of the mill ponds should be eliminated or treated.

[MUFEL' (P. P.) & GUTERMAN (É. M.).] Муфель (П. П.) и Гутерман (3. М.). Lutte contre les larves d'anophèles dans les étangs poissonneux. [In Russian.]—Med. Parasitol. 6 no. 2 pp. 239-242, 2 refs. Moscow, 1937. (With a Summary in French.)

In view of the fact that fish die in water that has been oiled for the control of Anopheline larvae, experiments to study the effect on them of arsenical dust larvicides were carried out in the summer of 1936 in the Province of Voronezh. For this purpose, three large artificial water reservoirs containing dense aquatic vegetation and infested with Anopheline larvae were stocked with very young and one-yearold carp; the plants rising above the surface of the water were cut. and the water was repeatedly treated with dust shaken from a muslin net. In one dusted with Paris green mixed with oleogumbrin [cf. R.A.E., B 25 68] in the proportion of 1:20, the film that formed on the surface remained intact for several days, and the number of larvae was reduced from 4.7 to 0.0-0.004 per sq. metre. Another reservoir was dusted with a mixture of calcium arsenite, Paris green and oleogumbrin, which gave less than 50 per cent. control and the third with calcium arsenite mixed with road dust (1:10), which reduced the number of larvae per square metre from 12.7 to 2.3. Analysis of the water before and after the treatments showed that there was no appreciable change in its composition, and no changes occurred in the plankton and benthos. The condition of the fish was not affected in any way. This was confirmed in laboratory experiments in which young fish were placed in glass jars and the water was dusted with mixtures of oleogumbrin and calcium arsenite or Paris green. The films remained on the surface of the water for 5-6 and 24 hours, respectively, and the fish continued to be very active and in perfect

(439) [B]

condition. In another experiment, young fish and Anopheline larvae were kept in a wooden box placed in one of the artificial reservoirs so that it was half full of water. The fish were dissected 2–3 days after dusting and their digestive tract analysed for the presence of arsenic. The results were invariably negative. The fish were very active all the time, and the larvae were quickly destroyed by them.

[Selivanov (K. P.).] Селиванов (К. П.). The Use of Mosquito Traps in the Fumigation of Mosquitoes. [In Russian.]—Med. Parasitol. 6 no. 2 pp. 243–249, 5 figs. Moscow, 1937. (With a Summary in English.)

Experiments in Azerbaijan have shown that mosquitos in houses can be effectively destroyed by fumigating the rooms with smoke and trapping the mosquitos that attempt to leave them [cf. R.A.E., B 23 281]. The trap consists of a rectangular box with the back, sides, top and cone entrance made of wire gauze and with a sliding wooden bottom through which the mosquitos can be removed. It is placed in a hole in the wall of the room close to the floor, and the room is darkened so that it is the only source of light. A weak concentration of any kind of smoke is sufficient to drive the mosquitos into the trap, and the room is freed from them in less than an hour. Unsatisfactory results are obtained, however, if the hole for the trap is at some distance above the floor, as the mosquitos are prevented from flying to it by the screen of smoke, which tends to rise upwards, or if the back of the trap is made of wood so that it does not admit light.

[Shmeleva (Yu. D.) & Shlenova (M. F.).] Шмелева (Ю. Д.) и Шленова (М. Ф.). Contrôle entomologique direct de l'efficacité des moustiquaires des lits et du grillage. [In Russian.]—Med. Parasit. 6 no. 2 pp. 250-258, 8 refs. Moscow, 1937. (With a Summary in French.)

The value of screening the windows of houses against mosquitos and of using mosquito nets was studied in 1934 and 1935 in a peat-bog district in the Province of Moscow. Examination of mosquitos caught entering huts and cow-sheds showed that few had engorged in the open, and men are very seldom attacked out of doors. The workmen's huts were divided into three groups; one comprised huts with the windows screened, the second huts in which mosquito nets were used, and the third served as a control. It was found by collection that the number of mosquitos resting by day in the control huts was more than twice as great as in screened huts with ordinary doors, and ten times as great as in screened huts with spring doors. Even partial screening was of some value. Of the mosquitos trapped when attempting to leave huts in which mosquito nets were used on the beds, 41.6 and 34.6 per cent. were engorged in 1934 and 1935, as compared with 85.9 and 76.2 per cent. of those leaving the control huts. Observations showed, however, that most of the mosquitos that attacked workmen in the huts with mosquito nets did so when the men were not resting.

It is concluded that the use of mosquito nets in screened huts would afford considerable protection, but that it is also important to destroy the mosquitos in the huts [cf. R.A.E., B. 23 76].

VIOLLE (H.) & SAUTET (J.). Contribution à l'étude du colibacille chez le Culex pipiens, race autogène des fosses septiques.— C. R. Soc. Biol. 126 no. 26 pp. 368-370. Paris, 1937.

The results are given of experiments to determine the fate of Bacillus coli in the digestive tracts of larvae, pupae and adults of the autogenous race of Culex pipiens, L., from septic tanks in France [cf. R.A.E., B 21 62]. In the case of larvae and pupae, the external body wall was sterilised, so that any bacteria subsequently derived from the culture of the macerated body must have originated in the digestive tract; the adults were reared from surface-sterilised pupae. It was found that the intestines of the larvae and pupae contained numerous bacilli, whereas those of the adults were sterile. Even adults taken without sterilisation from a small experimental septic tank were almost always uncontaminated. Thus it would seem that infection is unlikely to result when adults emerging from septic tanks bite man or are crushed on the skin.

KHALIL (M.). The Research Institute and the Endemic Diseases

Hospital. 4th Annual Report 1934.—Imp. 8vo, x + 106 pp.,
28 pls. (7 fldg.), 3 figs. Cairo, Minist. Publ. Hlth Egypt, 1936.

In the section dealing with medical entomology (pp. 27-68) are given the results of the identification of collections of mosquito larvae and fleas sent from various localities in Egypt. Of the fleas examined, over 95 per cent. were Xenopsylla cheopis, Roths. The mosquitos included Anopheles pharoensis, Theo., A. multicolor, Camb., A. sergenti, Theo., A. coustani, Lav. (mauritianus, Grp.), Aëdes aegypti, L., and Culex pipiens, L., a proved vector of Filaria bancrofti [cf. R.A.E., B 20 159]. Accounts are given of brief mosquito surveys in three localities and of the recommendations made for the control of breeding; the distribution of the various species is shown on maps.

The area controlled by the Khanka Malaria Research Station is described, and the seasonal prevalence and distribution of the mosquitos found there are shown in a table and maps. The most prevalent Anopheline is A. pharoensis, which breeds from May to December, mainly in rice-fields and borrow pits in which there is an abundant growth of weeds. The adults readily enter houses and are responsible for the spread of malaria in places in which rice is cultivated [cf. 24 295; 25 230]. A. multicolor, which is the next most abundant species, breeds in salty water in such places as sand quarries and borrow pits; larvae are found throughout the year but are most plentiful from May to December. C. pipiens is widely distributed in the area and breeds all the year round in wells, borrow pits, etc.; 88 cases of filariasis have been detected during routine blood examinations at the Research Station. The control measures that are being carried out comprise draining and filling, clearing of vegetation, the use of larvicides (Paris green and oil) and the introduction of larvivorous fish.

SWEET (W. C.) & RAO (B. A.). Races of A. stephensi Liston, 1901.—

Indian med. Gaz. 72 no. 11 pp. 665-674, 2 graphs, 17 refs.

Calcutta, November 1937.

The results are given of measurements of the ova of Anopheles stephensi, List., from various parts of India. They indicate that

there are two distinct forms, of which one, form B, was obtained from Poona, Calcutta, Delhi and the cities of Mysore and Bangalore, and the other, form M, from Poona, Sind and Mysore, but not the two cities there. The authors consider B the type form of the species and

name the other form A. stephensi var. mysorensis, n.

The following is taken from the authors' summary: So far, the only demonstrable anatomical differences between these types are in the average measurements of length of ova, their greatest breadth including floats, and the length of the floats, the average number of ridges on the float, and the average proportion of the total length that is covered by the floats, figures for the B type being the greater in each instance. There seems to be no evidence that climate, breeding place, food of the larvae, or size of female has any effect on the measurements of the ova, and measurements of the ova of A. culicifacies, Giles, do not show that in this species there are any significant differences in averages. The B type seems to be hardier than the M type, to live longer in captivity, and to feed avidly on human blood, whereas females of the M type are only induced with difficulty to feed on any blood and leave the impression that they prefer that of animals. The B type lays eggs more readily in captivity; a B colony was easily established and maintained and bred true through at least nine generations, whereas no colony of the M type has yet been established and only 7 females of the F₁ generation have laid eggs, although these have bred true in egg measurements. In cross-breeding of B females with M males, the results are comparable with those reported for the crosses of the varieties of A. maculipennis, Mg., in Europe. Evidence as to the malaria-carrying potentialities of the two types is still vague, but seems to point to the B type being a good carrier and to the M type not being so.

Gore (Ramkrishna N.). A modified Village Mosquito Trap.—Indian med. Gaz. 72 no. 11 pp. 674–675, 3 figs., 1 ref. Calcutta, November 1937.

In this modified form of mosquito trap [cf. R.A.E., B 25 5], the four rectangular pieces of cloth are replaced by a single piece of cloth one edge of which is sewn round all but two inches of a bamboo hoop made to rest on the outer edge of the earthen pot. When introduced into the pot, the cloth forms a cylinder almost touching the bottom, with a gap up the side to allow the mosquitos to reach the darker parts of the trap. The cloth is removed by means of three pieces of string, 12 inches long, tied to the hoop at one end and together at the other.

Hu (S. M. K.). Experiments on repeated Infections of Filarial Larvae in Culex pipiens var. pallens Coq.—Peking nat. Hist. Bull. 12 pt. 1 pp. 13–18, 5 refs. Peiping, September 1937.

In experiments in Shanghai, two batches of females of *Culex pipiens* var. pallens, Coq., were given an opportunity to feed twice, at intervals of 6 and 8 days, respectively, on a man showing large numbers of microfilariae of Filaria (Wuchereria) bancrofti in the blood. From dissections of mosquitos that fed on both occasions, it was found that some of the mosquitos were susceptible to infection only at the time of the first blood-meal and some only at the time of the second. In some of the mosquitos that harboured both broods of filarial larvae,

there was a considerable difference in the numbers belonging to each brood, so that the same mosquito would appear to be more susceptible to infection on one occasion than on another.

CHANG (Teh-ling). Notes on the Egg Production of Anopheles hyrcanus var. sinensis Wied. in Shanghai Region.—Peking nat. Hist. Bull. 12 pt. 1 pp. 23–26, 4 refs. Peiping, September 1937.

The average number of eggs per female laid by 334 engorged females of Anopheles hyrcanus var. sinensis, Wied., caught in cattle-sheds in the Shanghai region in 1935 and kept in the laboratory without further blood meals was 133.1.

Nationaal Rapport van Nederlandsch-Indië voor de Intergouvernementeele Conferentie van Landen in het Verre Oosten voor landelijke hygiene, 3-13 Augustus 1937. Volkenbond, Hygiëne-organisatie. [National Report of the Netherlands Indies for the Intergovernmental Conference of Far-Eastern Countries on Rural Hygiene, 3rd-13th August, 1937. League of Nations, Health Organisation.]

-Meded. Dienst Volksgezondh. Ned. Ind. 26 no. 3 pp. 99-216, 13 pls., 8 diagr. Batavia, 1937.

This report deals with the medical and sanitary services of the Netherlands Indies, and includes sections on the epidemiology and control of plague and malaria. Plague is important only in Java, Xenopsylla cheopis, Roths., being the chief vector and Mus (Rattus) rattus diardii the chief host. The section on malaria includes a list of the Anopheline vectors and notes on their importance and breeding places and on the measures employed for their control [cf. R.A.E., B 25 261, etc.].

Sorel (—). Sur le comportement de l'endémie pesteuse dans les colonies françaises, particulièrement au cours des deux dernières années.—Bull. Off. int. Hyg. publ. 29 no. 10 pp. 2071–2092, 1 graph, 2 refs. Paris, October 1937.

An account is given of plague in Senegal, Madagascar and Indo-China, with particular reference to the years 1935 and 1936, and of its characteristics in these countries. The various sections deal with the incidence of the disease, rates of mortality and means of dissemination; murine plague; the biology of the vector fleas; the methods used to limit or eradicate foci; measures against rats and fleas; vaccination; and treatment.

In Senegal during 1936, 58,803 fleas were collected from 62,824 rats, giving a general index for the year of 0.9. Fleas were most prevalent from March to July, the indices for May and June being 2.19 and 2.35. Of 14,934 fleas from rats examined during 1935 and 1936, 10,614 were Xenopsylla cheopis, Roths., 2,901 Echidnophaga gallinacea, Westw., 750 Ctenocephalides (Ctenocephalius) felis, Bch., and 669 Synosternus pallidus, Tasch.; the proportions in which the first two species occur are more or less stable, but those of the last two vary considerably from year to year. Of 657 fleas taken from the ground in huts during the first half of 1935, 94 per cent. were S. pallidus, 1.37 X. cheopis, 4.5 E. gallinacea and 0.15 C. felis.

In Madagascar, X. cheopis is again the most important species. In surveys carried out in Tananarive and Tamatave, whether in the hot, wet season or the cold, dry one, it represented about 60 per cent.

of the fleas on rats, Leptopsylla segnis, Schönh. (musculi, Dug.) 25 per cent., and E. gallinacea 15 per cent. C. felis and Pulex irritans, L., were only rarely observed. At Tananarive there appeared to be no correlation between the index of X. cheopis and the incidence of plague. On an average, 12-13 examples of this flea were found per rat, but the numbers varied from 0 to more than 100. It was rarely found free in the nests of rats in native huts or in the burrows outside, but occurred in large numbers in the débris resulting from the grinding of rice and in the dust in the huts [cf. R.A.E., B 22 156; 23 181]. It may be found in the fields under the large heaps of ground-nuts that harbour rats. When caught in houses from 20 days to 3 months after cases of human or murine plague, it has consistently infected guineapigs. Synopsyllus fonquernii, Wagn. & Roub., is frequently found on Mus (Rattus) rattus alexandrinus [cf. 21 25 [75]; it is most abundant on rats taken outside houses, particularly in the cold season, and is often found in burrows out of doors. It has been shown capable of becoming infected naturally or experimentally and of transmitting plague by its bites. It should therefore be considered a vector, even though its importance in nature is as yet unknown. Its numbers seem to have been increasing rapidly during the last few years. Dinopsyllus lypusus, J. & R., was found in burrows in a wooded region, but nothing is known of its distribution, hosts or ability to transmit plague. Inoculation of suspensions has shown that L. segnis and E. gallinacea can harbour the infection, but they do not transmit it by biting. Infection has not been demonstrated in P. irritans in Madagascar. Ceratophyllus fasciatus, Bosc, a usual parasite of rats in Europe and North Africa, has never been observed.

In Cambodia, the only flea taken on rats was X. cheopis; the numbers were small, an average of one flea to 5 rats. Of 311 fleas taken on 635 rats received for examination at the Pasteur Institute at Hanoi, 172 were X. cheopis, 115 L. segnis, 12 C. fasciatus and

12 Ctenocephalides (Ctenocephalus) canis, Curt.

ADVIER (M.). Etude expérimentale du rôle de Synosternus pallidus dans la transmission de la peste.—Bull. Soc. Path. exot. 30 no. 8 pp. 643-646. Paris, 1937.

The author describes in detail the cages and technique used in experiments carried out at Dakar between 1932 and 1934 to determine the importance of *Synosternus pallidus*, Tasch., as a vector of plague [cf. R.A.E., B **20** 202]. It transmitted plague from infected to uninfected rats in only 2 out of 22 experiments; the reason for the failures is unknown. Blocking of the proventriculus does not appear to occur in this flea, and it is possible that the plague bacilli are eliminated only in the excreta. The infection was shown to persist

in the flea for at least 24 hours after the infecting meal.

Identification of fleas collected at various times of the year in the town and suburbs of Dakar and in the surrounding villages showed that among 39,818 taken in the fur of various rodents, 28,402 belonged to the genus *Xenopsylla* and only 1,313 were *S. pallidus*, whereas among 24,428 taken in native huts, 22,668 were the latter species. Thus it does not appear to be a normal parasite of the animals that are the chief reservoir of plague, and therefore has little opportunity of ingesting the virus. This and its apparent inability to transmit the disease readily account for the fact that, although it is very

numerous in certain regions of Senegal, the epidemics of plague are not nearly so severe as they would be if it were a vector comparable to X. cheopis, Roths.

HOARE (C. A.). On the Nomenclature of the Trypanosome causing Acute Porcine Trypanosomiasis in Africa.—Bull. Soc. Path. exot. 30 no. 8 pp. 686-693, 18 refs. Paris, 1937.

The author further discusses the synonymy of the trypanosome causing acute trypanosomiasis in pigs in tropical Africa [cf. R.A.E., B 24 143; 25 251] and concludes that the correct name is Trypanosoma simiae, as T. suis is unrecognisable. F. Mesnil comments on this paper and continues to prefer the name T. suis.

DE BUCK (A.) & SWELLENGREBEL [N. H.]. Tentatives d'hybridation entre l'Anopheles maculipennis atroparvus et messeae des Pays Bas.—Bull. Soc. Path. exot. 30 no. 8 pp. 699-703, 7 refs. Paris, 1937.

In view of the fact that Diemer was successful in rearing hybrid adults in two instances from crossings of males of Anopheles maculipennis, Mg., race atroparvus, van Thiel, with females of race messeae, Flni. [cf. R.A.E., B 23 270], the author carried out, in 1936 and 1937, 16 further experiments [cf. 22 199] on the cross-breeding of these races. Although larger proportions of the females were fertilised and larger numbers of hybrid larvae were obtained, the results confirmed those of the previous experiments, for none of the larvae reached maturity. Since 5 out of 1,455 larvae resulting from the crossing of males of messeae with females of atroparvus did not die until they had moulted twice, it is possible that hybrid larvae might develop further and even give rise to adults, but it would seem unlikely that the latter would survive if produced in nature.

Toumanoff (C.). Premiers résultats d'essais d'accouplement et d'élevages au laboratoire d'Anopheles vagus au Tonkin.—Bull. Soc. Path. exot. 30 no. 8 pp. 704-708, 1 ref. Paris, 1937.

Toumanoff (C.). La reproduction en captivité de A. vagus au Tonkin.—Bull. Soc. méd-chir. Indochine 15 no. 7 pp. 776-784, 4 figs., 1 ref. Hanoi, 1937.

In each of these papers, the author describes the technique employed and the results obtained in rearing experiments carried out with Anopheles vagus, Dön., in Indo-China. Pairing occurred in the small cages used. In some cases two consecutive generations were reared, and in one case three. Females reared in the laboratory were more easily fertilised by males caught in nature than by those reared in the laboratory, which were fed on glucose.

CORRADETTI (A.). Revisione critica degli studi sul comportamento sessuale e sugli incroci tra le diverse varietà di Anopheles maculipennis. [A critical Survey of Studies on the Sexual Behaviour and Crosses between the different Varieties of A. maculipennis.]—Riv. Parass. 1 no. 4 pp. 329-341, 22 refs. Rome, October 1937.

This is a survey from the literature of the sexual behaviour of the races of Anopheles maculipennis, Mg., among which A. sacharovi,

Favr (elutus, Edw.) is included, and of the results of crossing them. The evidence suggests that race atroparvus, van Thiel, behaves sexually in a different manner from the other known races, being the only one of which the males pair in a confined space. In all crosses, the vitality and fertility of the hybrids vary according to the races crossed, and the genetic affinities of atroparvus with the other varieties decrease in the following order: labranchiae, Flni., melanoon, Hackett, maculipennis (typicus), A. sacharovi, and messeae, Flni. Even atroparvus and labranchiae are, however, so distinct that nearly all the male hybrids have atrophied testicles. The degree to which the characters of the hybrids follow Mendelian laws is discussed in some detail.

Cory (E. N.) & Crosthwait (S. L.). A large-scale Demonstration in Mosquito Control.—J. econ. Ent. 30 no. 5 pp. 711–712. Menasha, Wis., October 1937.

A demonstration of the control of mosquitos by ditching salt marshes to drain the sheet water between tides and permit the access of minnows at high tide was begun in Maryland in November 1935, with a view to interesting the public in such control. The effect on the marsh flora and fauna is being carefully studied.

KNIPLING (E. F.) & TRAVIS (B. V.). Relative Importance and Seasonal Activity of Cochliomyia americana C. & P. and other wound-infesting Blowflies, Valdosta, Ga, 1935–1936.—J. econ. Ent. 30 no. 5 pp. 727–735, 1 graph, 16 refs. Menasha, Wis., October 1937.

These investigations on the species of blowflies infesting wounds of animals were carried out in the vicinity of Valdosta, Georgia, from September 1935 to December 1936, on long-woolled sheep, short-haired goats, and a few calves, all of which were artificially wounded and released in a pasture. In most cases one wound was made in the centre of a closely clipped area 6–8 inches in diameter on the rump, another in a similar area on one shoulder and a third on an unclipped area on the other shoulder, the wounds in the clipped areas being

intended to simulate severe shearing cuts.

The following is taken from the authors' summary: Cochliomyia hominvorax Coq. (americana, Cush. & Patt.) is the most important species causing myiasis of wounds in this region. Wounds on the clipped shoulders of sheep were the most attractive to it, followed by those on the unclipped shoulders of goats. Wounds on the unclipped shoulders of sheep were the least attractive to C. hominivorax, but the most attractive to C. macellaria, F. The types of wounds studied were most attractive to C. hominivorax when they were about 5–7 days old. The activity of this fly appeared to be as great on days when the maximum air temperature was 75°F. as when it was 80°F., but decreased greatly when it fell below 70°F. A minimum temperature of 24°F. did not apparently kill the adults in nature.

C. macellaria, Phormia spp., Lucilia spp. and Sarcophaga spp. were the only secondary flies that initiated infestations in wounds. Sheep were more susceptible to infestation by secondary flies than either goats or calves. The predominant secondary species in the wounds were C. macellaria from August to October, Phormia spp. from

November to March, and Lucilia spp. from April to July.

Lindquist (A.). Myiasis of Wild Animals in southwestern Texas.—

J. econ. Ent. 30 no. 5 pp. 735-740, 2 figs., 3 refs. Menasha, Wis., October 1937.

An account is given of an investigation carried out in Texas on myiasis in wild animals. The 37 cases studied occurred in cottontail rabbits, jack rabbits, deer and opossum, and most of them in all these animals were due to *Cochliomyia hominivorax*, Coq. (americana, Cush. & Patt.). Four per cent. of the 298 rabbits examined were infested, and it is concluded that wild animals are an important source of infestation for domestic stock.

Parish (H. E.). Flight Tests on Screwworm Flies.—J. econ. Ent. 30 no. 5 pp. 740-743. Menasha, Wis., October 1937.

In 5 tests carried out in Texas during the period 28th August to 22nd October 1935 on the flight range of Cochliomyia hominivorax, Coq. (americana, Cush. & Patt.), 140,000 reared adults, 1–3 days old, were coloured with finely powdered red chalk and liberated. The distance of flight was determined by examining the flies that visited fly-traps baited with meat or cattle having necrotic wounds infested with larvae of C. hominivorax, which were placed at different distances from the point of liberation. It was found that the flies are capable of flying at least 9 miles. The infested wounds were more attractive than the fly-traps.

Horsfall (W. R.). Mosquitoes of southeastern Arkansas.—J. econ. Ent. 30 no. 5 pp. 743-748, 1 ref. Menasha, Wis., October 1937.

Work on the mosquitos of south-eastern Arkansas was continued in 1936 [cf. R.A.E., B 25 6]; 29 species have now been collected and details are given of seasonal occurrence and breeding places.

GALVÃO (A. A.), LANE (J.) & CORRÊA (R.). Notas sobre os Nyssorhynchus de S. Paulo. V. Sobre os Nyssorhynchus de Novo Oriente.

[Notes on the Nyssorhynchus of S. Paulo. V. On the Nyssorhynchus of Novo Oriente.]—Rev. Biol. Hyg. 8 (1) pp. 37-45, 2 pls., 7 refs. São Paulo, August 1937. (With a Summary in English.)

[Recd. December 1937.]

Anophelines of the *Nyssorhynchus* group taken in March 1936 and February-May 1937 at or near Novo Oriente in the State of São Paulo comprised *Anopheles tarsimaculatus*, Goeldi, *A. albitarsis*, Arrib., *A. argyritarsis*, R.-D., *A. strodei*, Root, *A. bachmanni*, Petrocchi, and a new variety of *A. darlingi*, Root, *paulistensis*, var. n., which is described from the adults of both sexes and the eggs. The adults differed from the typical variety in external characters and male genitalia, the larvae and pupae conforming to the type. Adults taken in several other districts appeared to belong to the new variety.

The eggs of A. tarsimaculatus much resembled those figured by Root in a paper already noticed [R.A.E., B 14 197] but differed from them in the exochorion, presenting features similar to those in A. strodei and A. darlingi var. paulistensis. Females of A. bachmanni, of which the eggs are described and figured, were taken exclusively in houses. No males were found. Brief notes are given on the morphology of the other species collected. A. darlingi var. paulistensis represented 79·7-100 per cent. of the Anophelines taken in houses during the

malaria season and is probably the chief local vector of the disease. Only five larvae of this variety were taken, one in a stream and four in a series of lakes into which it flowed, although larvae of the other species were common in both.

Bellosillo (G. C.). Herpetomonas muscarum (Leidy) in Lucilia sericata Meigen.—Philipp. J. Sci. 63 no. 3 pp. 285-305, 5 pls., Manila, 1937. 15 refs.

A detailed account is given of the morphology and life-history of Herpetomonas muscae-domesticae (muscarum), which is a common parasite of Lucilia sericata, Mg., in California, and of experiments on the infection in adults and larvae of this fly. Infection occurs by ingestion of the flagellates excreted by flies on their food. The adults are thus readily infected, as they move constantly from one food to another, but the larvae, which seldom feed on the surface of their food or move about, are not generally infected in nature. Hereditary transmission does not occur.

SMITH (R. O. A.) & MEHTA (D. R.). Studies on Typhus in the Simla Hills. Part VII. Attempts to isolate a Strain of XK Typhus from Wild Rats.—Indian I. med. Res. 25 no. 2 pp. 345-351, 10 refs. Calcutta, October 1937.

MEHTA (D. R.). Studies on Typhus in the Simla Hills. Part VIII. Ectoparasites of Rats and Shrews with special Reference to their possible Rôle in the Transmission of Typhus.—T.c. pp. 353-365,

2 charts, 16 refs.

On the assumption that, in the Simla Hills, rats are the reservoir of both the XK and the X19 forms of typhus [cf. R.A.E., B 24 105, 189], attempts were made to isolate the XK form from rats trapped in Kasauli and the surrounding villages during 1936 and 1937, or from their parasites, which comprised Liponyssus bacoti, Hirst, Ceratophyllus simla, J. & R., Rhipicephalus sp., and Xenopsylla cheopis, Roths.,

but the results were negative.

To determine whether any mutation of the virus of the X19 form would occur in its passage through Arthropods other than fleas, as well as to investigate the part they play in its transmission, larvae and nymphs of Rhipicephalus sanguineus, Latr., and mites (Liponyssus bacoti) bred in the laboratory were fed on guineapigs and rats infected with the laboratory strain, and after varying periods suspensions of them were injected into healthy guineapigs; no reactions were observed. A scrotal reaction and fever typical of typhus X19 was, however, produced in a guineapig into which was injected a suspension of fleas (C. simla) that had fed on an infected rat under similar conditions.

At a time when cases of typhus of the XK type were occurring in man, fleas $(X.\ cheopis\ and\ C.\ simla)$ were collected from wild rats, made into suspensions and injected into guineapigs to determine whether they have any relation to the disease. In some cases reactions were observed, but for various reasons these were held to be due to infections with the virus of typhus X19. It is concluded that fleas are unlikely to be concerned in the transmission of the XK form of typhus in this area. No cases of the X19 form occur during the post-monsoon period, when X. cheopis reaches its maximum numbers on rats and has been shown to be infected [cf. 24 189]; this is remarkable if the human and murine viruses are identical and the flea is the vector from rat to man.

In the second paper, a detailed account is given of the ectoparasites found on some 2,400 rats and a few other rodents and shrews trapped at Kasauli and Sabathu in the Simla Hills during 1935–36 and of their seasonal distribution, and their possible relation to typhus is discussed. Possible vectors of the XK (rural) form include the mite, Trombicula deliensis, Walch, which is found on rats throughout the year and is particularly abundant during the season when cases of this type of typhus occur at Kasauli and Sabathu, and Hyalomma savignyi, Gerv. (aegyptium, auct.), which is the commonest tick and is also particularly numerous at the time when cases of XK typhus are being reported. At this time, larvae and nymphs of this tick are found on rodents and possibly on other small mammals, while the adults engorge on goats and sheep. X. cheopis and C. simla are considered to be the likely vectors of the X19 (urban) form.

CHOPRA (R. N.) & BASU (B. C.). A preliminary Report on the Effect of Anti-malarial Drugs upon the Infectivity of the Patients to the Mosquitoes.—Indian J. med. Res. 25 no. 2 pp. 459-464, 13 refs. Calcutta, October 1937.

The literature on the effect of various drugs on the development of malaria parasites in Anophelines subsequently fed on the treated persons is briefly reviewed, and an account is given of the results of experiments in which 4,665 females of Anopheles stephensi, List., were allowed to engorge on treated gametocyte-carriers. Plasmoquine in doses as small as 0.02 gm. prevented the development of Plasmodium falciparum, whereas atebrin, quinine sulphate, cinchona febrifuge, tebetren, and gametochin failed to do so, and, in some cases, high percentages of gut and gland infections were observed after the usual course of treatment with these drugs. Three doses of atebrin or of malarcan prevented the development of P. malariae, but 15 doses of tebetren did not. A small dose of quinine sulphate prevented the development of P. vivax, but plasmoquine in doses of 0.02 gm. did not prevent its reaching the oöcyst stage.

SWAMINATH (C. S.) & SHORTT (H. E.). The Arthropod Vector of Babesia gibsoni.—Indian J. med. Res. 25 no. 2 pp. 499-503, 3 refs. Calcutta, October 1937

After briefly reviewing the literature on the transmission of Piroplasma (Babesia) gibsoni, a parasite of dogs and jackals in India [cf. R.A.E., B 15 204; 22 102], the author gives an account of experiments carried out with Haemaphysalis bispinosa, Neum. The procedure is described; precautions were taken to prevent the dogs and jackals becoming infested with other ticks. In 8 of the 15 experiments, the parasite was successfully transmitted, either by adults infected in the nymphal stage or by larvae or nymphs derived from infected adults. The average incubation period, counting from the time of attachment of the ticks, was 15 days.

Delpy (L.). Description de Hyalomma dromedarii (Koch 1844).

Morphologie de la larve et de la nymphe.—Ann. Parasit. hum. comp. 15 no. 6 pp. 481-486, 12 figs. Paris, 1st November 1937.

Delpy (L.) & Gouchey (S. H.). Biologie de Hyalomma dromedarii (Koch 1844).—T.c. pp. 487-499, 5 figs., 8 refs.

These papers comprise, respectively, descriptions of the egg, larva and nymph of *Hyalomma dromedarii*, Koch [cf. R.A.E., B 24 197],

and an account of its bionomics, based on a study in Persia of 51 families (each the progeny of a single female) reared through 1-4

generations.

The following is taken from the authors' summary of the second paper: H. dromedarii is normally a three-host tick that occasionally completes its development on two hosts and so avoids unfavourable climatic conditions. The natural host of the larva is unknown; the preferred hosts of the nymphs and adults are firstly camels and secondly cattle. In the laboratory, the larvae were satisfactorily reared on rabbits or calves, but not on camels or sheep. Nymphs and adults were easily reared on all these animals, except sheep, on which they rarely engorged. The shortest life-cycles were observed in the hot season and occupied at least 93 days; in temperate or cold weather they may last 280 days or more. Two generations may be obtained in a year, a short summer cycle alternating with a long winter one. The differences in the lengths of the life-cycles are due chiefly to differences in the lengths of the incubation period or the periods from engogement to moulting or oviposition, those of engorgement at all seasons being almost constant.

LE ROUX (P. L.). Annual Report of the Veterinary Research Officer 1936.—Rep. vet. Dep. N. Rhod. 1936 pp. 46-70. Lusaka, 1937.

From October to February, cattle at the Mazabuka Research Station, Northern Rhodesia, were dipped every 5 days in a dip of 7-day strength, excepting those on the Kafue Flats, which were dipped at intervals of a fortnight or three weeks. The trek oxen were dipped weekly even during the working season. From March to the end of September, the animals were dipped once a week. To this regular dipping is attributed the appreciable decrease in numbers of disease-transmitting ticks (Rhipicephalus appendiculatus, Neum., R. evertsi, Neum., R. simus, Koch, Boophilus annulatus decoloratus, Koch, and Amblyomma variegatum, F.). It did not appear, however, to affect the incidence of Hyalomma impressum, Koch, which continued to be found in undiminished numbers, especially in the brush, at the root of the tail, and at the base of the horns. Unless it was removed by hand it caused abcesses, which frequently became infested with larvae of blowflies. Even animals dressed by hand on the days on which they were dipped continued to be infested, and it was not unusual to recover 10-20 ticks from a brush two days after treatment. The wash did not apparently penetrate to the skin, and in future it is proposed to clip the brushes when the ticks are most active. The failure of some ranchers to keep cattle free from disease-transmitting ticks is attributed to dipping irregularly or to using too weak a solution. Various requirements for dipping in a more satisfactory manner are described.

NIESCHULZ (O.) & DU TOIT (R. M.). Investigations into the Transmission of Horse-sickness at Onderstepoort during the Season 1932–1933.—Onderstepoort J. vet. Sci. 8 no. 1 pp. 213–268, 4 figs., 5 refs. Pretoria, 1937.

Experimental work at Onderstepoort on the transmission of horse-sickness [cf. R.A.E., B 23 145] was continued in 1932–33, primarily with the object of determining to what extent the negative results

previously obtained had been due to the use of unsuitable strains of the virus.

The following is taken from the authors' summary: In spite of the extraordinarily dry summer, horse-sickness was extremely severe throughout the country and horses that were always stabled at night were among those that contracted the disease, so that, contrary to general opinion, there appears to exist no very close relation between rainfall and the incidence of horse-sickness, and stabling at night does not afford adequate protection against infection. A second mosquito survey [cf. 22 263] showed that the important field species are Aides caballus, Theo., A. lineatopennis, Ludl., A. hirsutus, Theo., A dentatus, Theo., and A. (Mucidus) mucidus, Karsch. Larvae of Anopheles, particularly A. gambiae, Giles, A. pretoriensis, Theo., A. rufipes, Gough, and A. coustani, Lav. (mauritianus, Grp.) were present in fair numbers during the driest part of the season in a river bed and in a marshy area formed by leakage of water. Rain of even moderate intensity destroyed the breeding places. Anophelines appear to find suitable breeding conditions in very wet or very dry seasons, and had, therefore, to be considered as potential vectors.

Using the technique already described [22 263], 31 experiments were carried out in which 591 mosquitos that had fed on infected horses were injected subcutaneously into susceptible ones after intervals varying from 5 to 54 days and 615 others were re-fed on susceptible horses after intervals of 5 to 36 days. The only positive result was obtained from an experiment in which 8 examples of Anopheles gambiac, 8 of A. coustani and 7 of A. pretoriensis were injected as a suspension 7 days after they had fed on an infected horse. It is considered that a sufficient number of mosquitos of the important species of the promising groups have now been tested to justify the conclusion that mosquitos are not the vectors of horse-sickness. Negative results were obtained when suspensions of the eggs of 11 examples of Rhipicephalus appendiculatus, Neum., and of 1 of Hyalomma savignyi, Gerv. (acgyptium, auct.) that had engorged on an infected horse were injected into susceptible

Corson (J. F.). A second Note on the Infectivity to Man of a Strain of Trypanosoma rhodesiense: Resistance of two African Volunteers to Infection.—J. trop. Med. Hyg. 40 no. 21 pp. 263–266, 7 refs. London, 1st November 1937.

animals.

The experiments described were carried out with the strain of Trypanosoma rhodesiense that has been maintained since October 1934 in sheep and antelopes by cyclical passages through Glossina morsitans, Westw. [cf. R.A.E., B 25 224]. In each of two experiments, a single infected example of G. morsitans that had failed to infect one native volunteer subsequently infected another [cf. 23 135]. The infections produced by the bites of these flies in control animals gave no indication that the general virulence of the strain had become less during maintenance for nearly three years in ruminants nor that there was any change in the virulence of the trypanosomes within either of the flies during their infective life. Thus it appears that two of the men were more resistant than the other two and that in nature many persons may be bitten by infected flies without becoming infected. In this connection, the author briefly discusses the question of inapparent infection [cf. 25 17] and spontaneous recovery.

Schwetz (J.). Synopsis des phlébotomes actuellement connus au Congo Belge.—Rev. Zool. Bot. afr. 30 fasc. 1 pp. 155-163, 15 refs. Brussels, 30th October 1937.

The species of *Phlebotomus* known from the Belgian Congo are *P. africanus*, Newst., *P. africanus* var. niger, Parr. & Schwetz, *P. schwetzi*, Adl., Thdr. & Parr., *P. schoutedeni*, Adl., Thdr. & Parr., *P. decipiens*, Thdr., *P. dureni*, Parr., *P. simillimus*, Newst., *P. squamipleuris*, Newst. (guesquierei, Parr.), *P. collarti*, Adl., Thdr. & Parr., *P. ingrami*, Newst., *P. rodhaini*, Parr., *P. sanneri*, Gall. & Nitzu., *P. congolensis*, Parr., *P. gigas*, Parr. & Schwetz, *P. renauxi*, Parr. & Schwetz, *P. yvonnae*, Parr. & Schwetz, and *P. katangensis*, Beg. & Walr. Lists are given of the sandflies, showing their synonymy and the localities in which they were found, and of the localities, showing the species found in each.

Sun (C. J.) & Wu (C. C.). Notes on the Study of Kala-azar Transmission. Part II. Further Observations on the natural Infection of Phlebotomus chinensis with Leptomonas donovani.—Chin. med. J. 52 no. 5 pp. 665–673, 2 figs., 2 maps., 26 refs. Peiping, November 1937.

Investigations carried out in 1936 in two more villages of North Kiangsu in which cases of visceral leishmaniasis occurred revealed further natural infections of *Phlebotomus chinensis*, Newst., with flagellates of *Leishmania donovani* [cf. R.A.E., B **25** 1]. In one village, 10 out of 483 and in the other 1 out of 54 examples of this sandfly were infected. In the latter village, the predominant species was P. sergenti var. mongolensis, Sinton, which was also found to be naturally infected.

HERTIG (M.). Carrion's Disease. V. Studies on Phlebotomus as the possible Vector.—Proc. Soc. exp. Biol. Med. 37 no. 3 pp. 598-600, 3 refs. New York, December 1937.

To investigate the possibility of transmission of verruga (Carrion's disease) by sandflies [cf. R.A.E., B 17 189; 20 124, etc.], the author collected them in the verruga zone of Peru in March-June 1937, houses yielding almost exclusively *Phlebotomus verrucarum*, Tns., and excavations this species and *P. noguchii*, Shannon. When these sandflies were fed on patients in whose blood *Bartonella bacilliformis* was numerous, they became infected with a bartonella-like organism. A similar infection was found in one example of *P. verrucarum* out of a number of the wild sandflies examined. Transmission experiments with sandflies and monkeys (*Macacus rhesus*) gave negative results, but were too limited to be conclusive.

McCulloch (R. N.). The present Position in Blowfly Control in New South Wales with special Reference to the Problems associated with Jetting.—J. Aust. Inst. agric. Sci. 3 no. 3 pp. 129–137, 3 figs., 20 refs. Sydney, September 1937.

Measures for the control of blowfly attack on sheep in Australia are reviewed, and it is concluded that a combination of jetting and crutching constitutes not only the cheapest protection against strike [cf. R.A.E., B 25 51; 26 5], but also cheap control of the pest in the

absence of all other methods. Certain questions that prevent the unreserved recommendation of repeated jettings are discussed; from experiments it would appear that jetted sheep carry as much wool as unjetted ones, and that there is no danger to shearers from arsenical poisoning, but further investigation should be made on the effect of this treatment on breeding ewes. It is thought that body strike could be prevented by jetting parts of sheep affected by fleece-rot, and much practical experience, without precise experimental evidence indicates that jetting is at least as effective against head-strike in rams as it is against crutch-strike in ewes.

OBITZ (K.). The Cattle Grubs in Poland, their Distribution and Control. [In Polish.]—Pam. panstw. Inst. naukow. Gosp. wiejsk. Wydz. weter. 1 pp. 100-106, 1 map, 8 refs. Puławy, 1937. (With a Summary in English.)

Investigations in 1936 and 1937 and a critical survey of the data obtained previously [cf. R.A.E., B 25 200] showed that warble flies [Hypoderma] occur in all districts of Poland and infest some 30 per cent. of the cattle. The severest infestation is in the north-east. In a series of experiments against H. bovis, DeG., with different liquid larvicides applied with a stiff brush to the backs of the cattle, the best results were obtained with two proprietary preparations of derris, which gave apparent mortalities of 94·7 and 89·1 per cent. The whole of the mortality, however, may not be attributable to the larvicide, since some 15 per cent. of the larvae in the backs of four untreated animals were found to be dead.

Under experimental conditions, over 50 per cent. of the pupae died. Of 18 pupae of *H. bovis* that died 4–10 months after pupation, two contained pupae of Ichneumonids and must have been parasitised as larvae in the cattle, since they had been kept in covered containers from the time that they dropped from them. One pupa contained numerous Nematodes of the genus *Rhabditis*, one was infested with Microsporidia, and others contained bacteria or were attacked by a mould. Attempts to infest other pupae with this mould were

SACCHI (R.). Gli ectoparassiti dei polli. [The Ectoparasites of Fowls.]—Note Appunti sper. Ent. agrar. 3 pp. 43-73, 18 figs., 30 refs. Perugia, 1937.

unsuccessful.

Descriptions are given of the species of Mallophaga, mites and ticks that infest fowls, with general notes on their bionomics and control.

TOUMANOFF (C.). Persistence des sporozoites du paludisme chez A. minimus après plusieurs prises de sang sur les animaux.—Bull. Soc. Path. exot. 30 no. 9 pp. 765-767, 2 refs. Paris, 1937.

Records from Cambodia are given of two females of *Anopheles minimus*, Theo., infected in nature with malaria parasites, that subsequently fed on a buffalo 5 times in 20 days and 10 times in 17 days, respectively, and yet on dissection showed occysts in the stomach and numerous sporozoites in the salivary glands. The persistence of the sporozoites appeared in both cases to be the result of a development from occysts that was still in progress in mosquitos heavily infected or infected on successive occasions.

PIGOURY (L.). Piroplasmes et piroplasmoses en Syrie et au Liban.— Bull. Soc. Path. exot. 30 no. 9 pp. 767-772. Paris, 1937.

A brief survey is given of the parasites causing piroplasmosis of domestic animals that have up to the present been recorded from Lebanon and Syria, and, where possible, of the clinical symptoms of the infections for which they appear to be responsible. The ticks found on animals showing clinical symptoms are mentioned, since they

are the probable vectors.

Various species of Hyalomma were found on cattle infected with parasites resembling Piroplasma berberum and on horses infected with P. caballi and Nuttallia equi; in one case, Boophilus (Margaropus) calcaratus, Bir., was associated with the bovine piroplasmosis. Sheep and goats infected with various piroplasms usually harboured both Rhipicephalus sanguineus, Latr., and R. bursa, C. & F.; the latter seems the more likely vector, since it appears to be more closely associated with small ruminants than the former, which is found on almost all domestic animals. Piroplasmosis has also been observed during recent years in dogs imported from Europe; the vector is probably R. sanguineus.

Trelllard (M.). Définition et détermination pratique de tous les groupements d'espèces du genre Aëdes et des genres voisins.—Bull. Soc. Path. exot. 30 no. 9 pp. 778-784, 5 diagrs., 7 refs. Paris, 1937.

Synoptic tables, similar to those already devised for Anophelines [R.A.E., B 23 35, 101, etc.]; are given for identification of the larvae and adults of the genera of the tribe Culicini and the subgenera of Aëdes, Armigeres, Psorophora and Haemagogus, and of the adults of the groups of species in the subgenera that include more than one group.

STRATMAN-THOMAS (W. K.), BARBER (M. A.) & CARTER (J. C.). Extract of the Report of the Work of the International Health Division of the Rockefeller Foundation in Cyprus, 1936.—Annu. med. sanit. Rep. Cyprus 1936 pp. 44-54. Nicosia, 1937.

A detailed account is given of investigations on malaria carried out in Cyprus in 1936 [cf. R.A.E., B **24** 267]. During the spring, 6,001 persons from 116 villages were examined, and the average spleen and parasite rates were 29.7 and 31.5 per cent., respectively. Infections with Plasmodium vivax, P. falciparum and P. malariae have been found at altitudes of more than 4,000 feet above sea level, but spleen and parasite rates are highest at altitudes between 1,000 and 1,500 ft. A. superpictus, Grassi, is present over most of the island and breeds not only in mountain streams but also in rivers traversing the plain of the Mesaoria. Adults have been found at altitudes of more than 4,000 ft. A. sacharovi, Favr (elutus, Edw.) and A. claviger, Mg. (bifurcatus, auct.) are sporadically distributed, the former breeding chiefly in marshes and the latter in wells used for irrigation and in mountain streams [cf. 22 210]. The high infection rate in A. superpictus [cf. 24 267] and the preponderance of its breeding places make it the most important vector of malaria. The rivers and mountain streams in which it breeds are difficult to control permanently by any engineering procedure, because any construction is apt to be washed away by the torrent, A. sacharovi is of secondary importance because its breeding is restricted to marshes near the shore, and methods of controlling it by permanent draining have already been worked out. The importance of A. claviger as a vector has not yet been determined. Thus the primary problem in Cyprus is that of controlling rural malaria, of which at least 80 per cent. is transmitted by A. superpictus. The incidence of the disease is highest during the summer, because the mountain streams are reduced at this time to mere trickles, and the small pools of warm water on their margins form ideal breeding places for A. superpictus.

In the course of investigations into the seasonal incidence of transmission, it was observed that A. claviger and A. hyrcanus, Pall., are common during the winter and early spring; they probably play a minor part as vectors, at least during the spring. A. sacharovi and A. superpictus occur in abundance early in the season and at about the same time. Larvae of A. superpictus were found at the beginning of March at a distance of at least two miles from the nearest village, so that ovipositing females must range widely from the villages, where they commonly overwinter in stables, and any attempt to control the first broods of larvae by early treatment of breeding places must

be extended beyong the vicinity of overwintering shelters.

From dissections carried out during the period from March to December, it was found that the sporozoite rate was highest from June to the end of September; infected mosquitos were found in all months except April, and the numbers dissected in that month were small. Sporozoites were found in 2.1 per cent. of 1,645 examples of A. sacharovi, 5.3 of 2,026 of A. superpictus, and 7.6 of 104 of A. claviger. The infections found in March were in A. superpictus and had probably persisted from the previous year in overwintering females. Sporozoites were found in this species from May to November and the August index was 10·3. Infected examples of A. sacharovi were first found in May and in certain localities a high percentage was infected in June. From the parasite index of infants in highly malarious villages, it appears that the largest amount of transmission takes place during June-September; winter transmission seems to be low, and possibly nil, if prenatal infection be taken into account. Transmission occurs in the spring, certainly in May, and it seems probable that it also occurs in the autumn. A perfect programme of control should cover the months of March-October, inclusive, and possibly part of November, but if it is necessary to restrict the period considerably, it might be limited to June-September.

To prevent the breeding of A. superpictus and the loss of water by seepage, streams should be permanently channelled or tiled, but until this is possible, they should be trained and treated with larvicides. It seems probable that larvicides will always have to be used on certain streams that cannot be channelled and on irrigation ditches and seepages. Experiments have been carried out with various larvicides on various types of streams; a list is given of 6 that have proved more or less satisfactory. The method preferred for nearly all streams is the distribution by hand of a mixture of Paris green and road dust (1:100) but where dust has to be transported and stored, a spray of Paris green, kerosene and water is more practicable. The latter is prepared in units of 1½ gm. Paris green, 5 cc. kerosene and a drop or two of castor oil, which are mixed at the stream with 11 litres of water and 1-2 cc.

white of egg or a little dried albumen.

The report concludes with accounts of the engineering work that has been carried out during the year in connection with drainage schemes and of the manufacture on the spot of concrete pipes for drainage purposes.

PAPERS NOTICED BY TITLE ONLY.

- Wagner (J.). Notiz über die Aphanipteren Südserbiens. [List of the Fleas of southern Serbia.] [In Serbian.]—Bull. Soc. sci. Skoplje 17 pp. 134–136. Skoplje, 1937. (With a Summary in German.)
- Thompson (G. B.). A List of the Siphonaptera recorded from Ceylon, together with a number of new Records.—Ann. Mag. nat. Hist. (10) 20 no. 120 pp. 593-599, 1 ref. London, December 1937.
- Shortt (H. E.). Les maladies du genre typhus dans l'Inde [review of the literature 1934–36].—Bull. Off. int. Hyg. publ. 29 no. 11 pp. 2314–2327, 14 refs. Paris, November 1937.
- Tonelli Rondelli (M.). Ixodoidea. Parte I. Amblyomma ovale Koch, Amblyomma cajennense Fabricius e le specie a loro affini nuove o poco note. [A. ovale, Koch, A. cajennense, F., and new or little known Species allied to them.]—Riv. Parass. 1 no. 4 pp. 273–300, 18 figs., 16 refs. Rome, October 1937. (With Summaries in French, English and German.)
- Antunes (P. C. A.). & Lane (J.). Um novo Culex, Culex (Carrolia) soperi, encontrado em São Paulo (Diptera, Culicidae). [C. soperi, sp. n., in São Paulo.]—Rev. Biol. Hyg. 8 (1) pp. 21–23, 5 figs. S. Paulo, August 1937. [Recd. December 1937.]
- Antunes (P. C. A.). Notas sobre Flebotomus sul-americanos. I. Um novo Flebotomus, Flebotomus lloydi, encontrado em São Paulo. (Diptera, Psychodidae). [Notes on South American Phlebotomus. I. P. lloydi, sp. n., in São Paulo.]—Rev. Biol. Hyg. 8 (1) pp. 24–26, 3 figs., 4 refs. S. Paulo, August 1937. [Recd. December 1937.]
- [Mirzayan (A. A.).] Mirzajan (A. A.). Die Verdauungsstadien bei Phlebotomus papatasii Seop. [Stages of Digestion in adult Females of P. papatasii.]—C. R. Acad. Sci. URSS 17 no. 3 pp. 153–156. Moscow, 1937.
- Philip (C. B.). A Correction [to a paper on the affinis group of Tabanus].—Canad. Ent. 69 no. 9 pp. 207–208. Orillia, Ont., September 1937. [R.A.E., B 25 192.]
- Cushing (E. C.) & Hall (D. G.). Some morphological Differences between the Screwworm Fly Cochliomyia americana C. & P. [hominivorax, Coq.] and other closely allied or similar Species in North America (Diptera: Calliphoridae).—Proc. ent. Soc. Wash. 39 no. 7 pp. 195–200, 17 figs. Washington, D.C., November 1937.
- BACK (E. A.). **Bedbugs** [popular account of bionomics and control of *Cimex lectularius*, L.].—*Leafl. U.S. Dep. Agric.* no. 146, 8 pp., 7 figs. Washington, D.C., 1937.

[VUKASOVIĆ] VOUKASSOVITCH (P.) & DOJMI (L.). Contribution à l'étude biologique de Pediculoides ventricosus.—C. R. Soc. Biol. 126 no. 28 pp. 549-552. Paris, 1937.

For several years past, outbreaks of dermatitis caused by *Pediculoides ventricosus*, Newp., in men handling stored cereals have occurred in a district near Mostar, Jugoslavia, not only in autumn but also in spring [cf. R.A.E., B 25 153]. The principal host of the mite is *Sitotroga cerealella*, Ol., infesting barley in barns. Observations on the bionomics of *P. ventricosus* [cf. A 14 564] are recorded. The period of swelling of the abdomen lasted 6-7 and 16-17 days at 28 and 19·7°C. [82·4 and 67·5°F.], respectively; although swelling appeared normal at 37-40°C. [98·6-104°F.], young were not produced. The period during which young were produced varied with the temperature, but in some cases both fertilised and unfertilised females kept under various conditions ceased to reproduce for periods of up to 4 months and then recommenced. This faculty would permit the mite to reproduce in cycles, thus allowing its host to multiply, and so would explain its persistence in the barns.

WHITMAN (L.) & ANTUNES (P. C. A.). Studies on the Capacity of various Brazilian Mosquitoes, representing the Genera Psorophora, Aëdes, Mansonia, and Culex, to transmit Yellow Fever.—Amer. J. trop. Med. 17 no. 6 pp. 803-823, 18 refs. Baltimore, Md, November 1937.

ANTUNES (P. C. A.) & WHITMAN (L.). Studies on the Capacity of Mosquitoes of the Genus Haemagogus to transmit Yellow Fever.—

T.c. pp. 825-831, 10 refs.

Accounts are given of experiments to determine whether various species of Brazilian mosquitos can act as vectors of yellow fever; they include experiments carried out by the late N. C. Davis that have not previously been published. The technique used is described. The mosquitos were fed on infected monkeys (Macacus rhesus) and were subsequently re-fed after a suitable incubation period on susceptible monkeys or injected into them in the form of a suspension.

The following is taken from the authors' summaries: The efficiency as vectors of Aëdes scapularis, Rond. [R.A.E., B 18 166] and A. fluviatilis, Lutz [19 108] was confirmed. The virus was retained in the bodies of A. nubilus, Theo., A. terrens, Wlk., Mansonia juxtamansonia, Chagas, M. fasciolata, Arrib., M. chrysonotum, Peryassú, and M. albicosta, Chagas, but they were unable to transmit it by biting [cf. 20 10]. The authors could not confirm the transmission of yellow fever by the bites of Aëdes taeniorhynchus, Wied. [19 108] and are inclined to believe that it is not a vector, although the virus was retained in its body for long periods. In experiments by Davis, the virus was transmitted by the bites of Psorophora ferox, Humb., but the authors were unable to confirm this result, and they suggest that there may possibly be races of this species having varying capacities for transmission. In other experiments carried out by Davis, the virus was not transmitted by the bites of Aëdes fulvithorax, Lutz., or of Culex nigripalpus, Theo.

The Asibi strain of the virus was retained in the body of *Haemagogus janthinomys*, Dyar, for at least two weeks without exception, but in only one of six attempts was it transmitted by the bites of this species. In the single experiment with a species of *Haemagogus* tentatively

identified as *H. uriartei*, Shan. & Del Ponte, a strain of jungle yellow fever (M.A.J.) was used; it was retained in the body of the mosquito but was not transmitted by biting. Since the two species of *Haemagogus* did not live long in captivity, the interval between infection and testing was not longer than 16 days, and it is possible that the incubation period in these mosquitos may be longer [cf. 20 221].

BOYD (M. F.) & KITCHEN (S. F.). The Duration of the Intrinsic Incubation Period in falciparum Malaria in relation to certain Factors affecting the Parasites.—Amer. J. trop. Med. 17 no. 6 pp. 845–848, 3 refs. Baltimore, Md, November 1937.

In 96 successful inoculations of man with *Plasmodium falciparum* by means of examples of *Anopheles quadrimaculatus*, Say, infected with five strains of the parasite, the intrinsic incubation period varied from 6 to 25 days. The duration of this period did not appear to be influenced by the age of the sporozoites used in inoculation, the duration of the incubation period in the source of infection, the manner in which the source of infection was infected (by bites of mosquitos or injection of infected blood), the duration of the extrinsic incubation period, the quantitative infection of the mosquitos employed, or the race of the patient. It may possibly be influenced by the dosage of sporozoites, as indicated by the number of mosquitos employed. It varies widely with the different strains of the parasite, and the range of variation may perhaps be regarded as characteristic of a strain.

BOYD (M. F.), KITCHEN (S. F.) & KUPPER (W. H.). The Employment of multiply infected Anopheles quadrimaculatus to effect Inoculation with Plasmodium vivax and P. falciparum.—Amer. J. trop. Med. 17 no. 6 pp. 849–853, 2 refs. Baltimore, Md, November 1937.

In order to determine the infecting powers of females of Anopheles quadrimaculatus, Say, harbouring both Plasmodium vivax and P. falciparum, experiments were undertaken with mosquitos infected under conditions that would provide batches in which one species would mature before, at the same time as, and after the other.

The following is taken largely from the authors' discussion: These experiments prove that A. quadrimaculatus can be infected with both species of parasite under a variety of conditions and can transmit both. The sporogonous cycles of both are completed within the periods to be expected from the temperature of incubation, and prior infection by one does not adversely affect the other. On the other hand, the proportion of mosquitos infected with P. vivax was invariably greater than that infected with P. falciparum, regardless of the species concerned in the primary infection. Transmission of one species of parasite by a batch of mosquitos infected with both is attributable either to the earlier maturation of the cysts of one species, or to the earlier exhaustion or normal degeneration of the sporozoites of one species.

Senevet (G.). Les moustiques de la Guyane française (mission 1934).

—Arch. Inst. Pasteur Algér. 15 no. 3 pp. 352-382, 12 figs., 14 refs. Algiers, 1937.

During a visit to French Guiana in 1934, the author collected adults and larvae of mosquitos from localities in the low coastal area and from two or three points on the plateaux. He gives notes on the 18 species found; they included two new Culicines, which are described, Acides aegypti. L., and four species of Anopheles [cf. R.A.E., B 25 238], viz., A. tarsimaculatus, Goeldi, A. albitarsis, Arrib., A. bachmanni, Petrocchi, and A. darlingi, Root. From his own data and from the literature, which he reviews, he compiles a list of 25 species that probably occur. He considers that records of Anopheles albimanus, Wied., and A. argyritarsis, R.-D., from French Guiana [cf. 6 160] refer to A. tarsimaculatus and A. albitarsis, respectively.

Collignon (E.). La compagne antipaludique de 1936 dans le département d'Alger.—Arch. Inst. Pasteur Algér. 15 no. 3 pp. 383-397, 6 pls., 2 graphs, 1 ref. Algiers, 1937.

Ambialet (R.). Observations sur la campagne antipaludique de 1936 et sur les campagnes antérieures dans le département de

Constantine.—T.c. pp. 398-410, 3 pls. 12 graphs.

GOUGET (R.). La campagne antipaludique de 1936 dans le département d'Oran.—T.c. pp. 411-423, 5 pls., 10 graphs.

Accounts are given of the work carried out and the results obtained in the campaigns against Anophelines and malaria in Algeria in 1936 [cf. R.A.E., B 25 66]. The usual measures were employed against Anopheline larvae. The second paper includes a discussion of the use of Gambusia against them and of some of the reasons why it does not give such satisfactory results as might be expected, with suggestions for means by which its rearing and distribution might be more satisfactorily carried out. In the last two papers, the results of the work that has been done since 1932, as demonstrated by spleen indices for various localities, are reviewed; on the whole they appear to be satisfactory.

Lega (G.), Raffaele (G.) & Canalis (A.). Missione dell'Istituto di Malariologia nell'Africa Orientale Italiana. Relazione. [Mission of the Institute of Malariology in Italian East Africa. Report.]—
Riv. Malariol. 16 pt. 5 pp. 325–387, 33 figs., 4 maps, 2 graphs. Rome, 1937. (With Summaries in Italian, English and German.)

A preliminary malaria survey was made from December 1936 to March 1937 in Eritrea and Amhara, in the central portion of Abyssinia (between Diredawa and Addis Ababa and in Harar) and in Italian Somaliland. Many localities were visited, and particulars are given for each of the incidence of malaria, the Anophelines and their breeding places. Up to about 4,200 ft., there are areas of severe endemic malaria; the disease is less common and less severe at higher altitudes and almost absent above about 6,600 ft. Plasmodium falciparum, of which a new variety was found [see next abstract], predominated over P. vivax in the zones with severe endemics. P. vivax predominated at high altitudes. P. malariae was rare. Anopheles cinereus, Theo., A. demeilloni, Evans, A. coustani, Lav. (mauritianus, Grp.), Theo., A. d'thali, Patt., A. garnhami, Edw., A. garnhami var. walshi, Evans, and A. rhodesiensis, Theo., were found at high altitudes. A. cincreus and A. demeilloni also occurred in less elevated areas where malaria was severe, but only in association with A. gambiae, Giles, A. funestus, Giles, and A. pretoriensis, Patt., which are known to be important vectors. A. d'thali, however, was certainly a vector on the eastern plain. This species was also found in Eritrea as was (664) [B]

A. turkhudi, List. A. christyi, Newst. & Cart., occurred near Dessie. Climatic peculiarities of the high plateau are believed to be a factor in preventing epidemics of malaria; the very low night temperatures retard the development of the parasite in the mosquitos, so that very few of the latter survive until the completion of the cycle. Thus A. d'thali at Adowa and A. gambiae at Hala-Halem did not spread malaria. Some species of the high plateaux, such as A. cinereus and A. demeilloni, certainly have little tendency to bite man; they were abundant in cow-sheds where these were present. A. pretoriensis is often responsible for malaria in the highest localities where it is endemic. A. gambiae, the most dangerous African vector, predominated in the low plains and on the slopes and was also found in the high plateau region. A. funestus was common in Harar and in Somaliland.

RAFFAELE (G.) & LEGA (G.). Osservazioni su un ceppo etiopico di Plasmodium falciparum. [Observations on an East African Strain of P. falciparum.]—Riv. Malariol. 16 pt. 5 pp. 388–397, 1 pl. Rome, 1937. (With Summaries in Italian and English.)

From examination of cases of malignant tertian malaria in Italian East Africa it was found that, in addition to the typical *Plasmodium falciparum*, a variety occurs for which the name *aethiopicum* is proposed. The gametocytes of the variety mature more quickly than those of the typical form and differ in measurements, being on an average shorter and broader. A noteworthy difference was the very small numbers of Italian examples of *Anopheles maculipennis*, Mg. (races *labranchiae*, Flni., *messeae*, Flni., and *typicus*) that became infected after sucking blood rich in gametocytes, and the small numbers of oöcysts found in the stomachs of mosquitos that had become infected.

Jerace (F.). Sul potere infettante degli sporozoiti di Plasmodium relictum. [On the infective Capacity of the Sporozoites of P. relictum.]
 —Riv. Malariol. 16 pt. 5 pp. 398-403, 8 refs. Rome, 1937. (With a Summary in English.)

Sporozoites of *Plasmodium relictum* obtained from oöcysts dissected from *Culex pipiens*, L., were inoculated into 24 canaries, but none became infected. It thus appears that the sporozoites must pass through the salivary glands of the mosquito to become infective.

ROUBAUD (E.). Principes et possibilités de la prophylaxie animal du paludisme.—Arch. Inst. Pasteur Tunis 26 no. 4 pp. 625-664, 14 refs. Tunis, December 1937.

The author reviews at length the question of animal deviation of Anophelines as a factor in the disappearance of malaria from certain regions and the possibility of utilising it for the control of malaria in other regions, in the light of the knowledge that has been acquired since he first enunciated his theory on the subject [cf. R.A.E., B 3 141]. The fundamental basis of the theory was the recognition of the existence in Europe of essential biological and trophic differences between the various geographical populations of Anopheles maculipennis, Mg. Biological races were discovered of which the so-called anthropophilous races attacked man or animals indiscriminately

(undifferentiated zoophilism) whereas the zoophilous races attacked animals for preference (differentiated zoophilism). The attraction to animals shown by this Anopheline in agricultural regions where malaria is absent should therefore be considered the result of racial differentiation, preferences for feeding on domestic animals having developed and having resulted in the attraction of most of the mosquitos away from man. Malarious areas are characterised by the

presence of fundamentally anthropophilous races.

After the distinction of biotypes by means of the morphology of the egg, it was found that certain of them, labranchiae, Flni., sicaulti, Roub., and A. sacharovi, Favr. (elutus, Edw.) [regarded as a race of A. maculipennis] were definitely anthropophilous, and others, atroparvus, van Thiel, messeae, Flni., and maculipennis (typicus) were much more clearly zoophilous. Differences in hibernation habits were also observed. In Holland, where both races are zoophilous, it is the hibernating habits of atroparvus that account for the transmission of malaria, which takes place in winter, and the author considers that this confirms the reality of the protection afforded by animals in warm weather, when, in spite of the occurrence of malaria in man, the presence of infected Anophelines in houses is exceptional. The three anthropophilous races characterise regions where malaria is intense and of a serious type. Zoophilous races may be associated with them, but where pure populations of zoophilous races are present, malaria is absent, or present in a much less severe form. Throughout Europe north of the Alps, where the Anopheline fauna consists of the zoophilous races, malaria is obviously receding, and atroparvus appears always to be the vector.

Exceptional cases in which zoophilous races act as vectors are probably explained by the intervention of certain factors that upset the normal trophic equilibrium. Among these factors may be considered the sheltering of animals in human dwellings, overpopulation, periodic emigration to malarious regions, and camps of agricultural workers in marshy regions where there are no animals; all are the outcome of a low standard of living and render animal protection

insufficient at least during a part of the year.

The author considers that the solution of the problem of the control of malaria in regions where A. maculipennis is the vector lies in producing conditions that will permit the development of the zoophilous tendencies of the race or races existing in a given region, or favour the development of zoophilous populations at the expense of anthropophilous ones. One of the most important of these conditions is the maintenance of domestic animals, particularly at night, in permanent shelters close to human dwellings under conditions of darkness and freedom from draughts that will attract Anophelines. The importance of keeping a certain number of animals in these stables, even in warm weather, is emphasised. The presence of abundant animal nourishment under these conditions may result in the production of an immensely increased Anopheline population and consequently in a tendency for a part of it to be forced by competition to return to man. However, the principal factor affecting the multiplication of mosquitos is not the amount of blood available for the adults but the extent of the breeding places available for the larvae, for if the water surface is limited, an increase in the larval population gives rise to a competition rapidly becoming so intense that only a small number of larvae complete their development.

In regions where the Anopheline population is composed essentially of races exhibiting an undifferentiated zoophilism, such as Algeria and Morocco where populations of the group of *labranchiae* predominate, the mere introduction of animals would be of little value, for conditions favouring the anthropophilous races must be eliminated if the latter are to be replaced by zoophilous races. This would involve a fundamental change in the mode of housing of the inhabitants to reduce the degree to which they are exposed to attack by mosquitos.

The larvae that become established in the available breeding places will be those that are most active and most favoured by their surroundings, and in north Africa these are the larvae of *labranchiae* or *sicaulti*, which have a short hibernation period and are better adapted to an out-of-door existence than the zoophilous races with more pronounced entophilous habits. They are able to establish themselves earlier in the available breeding places at the expense of larvae that may

hatch later.

In Indo-China, although there are some 15 species of Anophelines, only a few appear to be concerned in the transmission of malaria. Of these A. minimus, Theo., is the most important, while A. jeyporiensis, James, A. aconitus Dön., and A. maculatus, Theo., are of secondary interest. These species all have a low maxillary index, just as the anthropophilous races of A. maculipennis. A study of the hosts of the different species showed that the multidentate ones are zoophilous and the paucidentate ones anthropophilous, although A. aconitus caught in houses near animal shelters has frequently been found engorged with animal blood, thus showing a tendency toward zoophilism that probably explains its secondary importance as a vector of malaria. For some of the species in this country, notably A. vagus, Dön., good animal shelters are not indispensable for animal deviation to be effective; in certain localities where the cattle and buffalos were kept in the open near dwellings, all or most of the Anophelines collected in neighbouring houses had engorged on animal blood. In general, there is a complete correlation between the feeding habits of the Anophelines of the Far East and the part they play as vectors of disease. Where, however, cattle are far from human dwellings, poorly stabled or scarce, certain zoophilous species, such as A. hyrcanus var. sinensis, Wied., may attack man vigorously and malaria may appear in an attenuated form. In Indo-China the abundance of cattle, often satisfactorily stabled, suggests that good results would be obtained from the application of zooprophylaxis, especially if it were combined with the usual antimosquito measures and particularly those used against larvae. In experiments in which specially constructed animal shelters were placed next to dwellings in localities in Cochin China where animal protection was not adequate, the percentage of the engorged Anophelines in houses that had fed on man was reduced from 80 to practically nil, the percentage that had fed on animals rising to 95-100. Most of the females of A. jeyporiensis and about 50 per cent. of those of A. minimus were attracted to animals.

Htt (S. M. K.). A brief Mosquito Survey of Foochow Region, South China.—Linguan Sci. J. 16 no. 4 pp. 579–584, 11 refs. Canton, 6th December 1937.

A list is given of the 20 species of mosquitos collected in the course of a survey carried out in the region of Foochow (Fukien) from 22nd

July to 30th August 1936, showing the breeding places of each and the species with which it was associated. The only Anophelines found were Anopheles lindesayi, Giles, larvae of which occurred in a shady pool in the bed of a partly dried stream, and A. hyreanus var. sinensis, Wied., larvae of which were found along the grassy banks of running streams in the ravines of the mountain region and the foothills, as well as in stagnant water in rice-fields, ponds, etc., on the uplands and in the plains. The latter was the only Anopheline taken among adult mosquitos collected in houses. Aëdes aegypti, L., was not observed, although many artificial containers and other types of apparently suitable breeding places were examined.

Yamada (M.). A new Species of Anopheles in Chosen (Korea).—Keijo J. Med. 8 no. 3 pp. 237-255, 5 pls., 47 refs. Keijo, Chosen, 20th October 1937.

All stages of Anopheles pullus, sp. n., are described from Korea. The larvae occur in water of a temperature of about 19°C. 66.2 F., containing various species of water plants, and can be found from April to late November, though in July and August they are restricted to cool springs or shaded ponds on high lands. Many adults engorged with blood were taken at night in stables and dwellings. The characters distinguishing this species from the other Anophelines occurring in Korea [R.A.E., B 25 91] and from other species resembling it are given.

Brug (S. L.). De vooruitzichten van filaria-bestrijding in Ned.-Indië. [The Prospects of Control of Filariasis in the Netherlands Indies.]
—Geneesk. Tijdschr. Ned.-Ind. 77 pt. 50 pp. 3202-3206.
Batavia, 14th December 1937.

In some parts of the Netherlands Indies, elephantiasis is rare or even absent in localities where filariasis is prevalent; thus at Bintaona, Celebes, 44 per cent. of the population were infected with *Filaria malayi* when only 1·2 per cent. were suffering from elephantiasis and the cases were mild. In other areas, however, elephantiasis is an important problem, affecting up to 20 per cent. of the population.

If control of the disease is to be effected by measures directed against the vectors, Filaria bancrofti and F. malavi must be considered separately, as different mosquitos are concerned. Knowledge on the transmission of F. bancrofti is completely inadequate, at least in the Netherlands Indies. Culex fatigans, Wied., used to be considered the chief vector, but Elsbach found that Anopheles bancrofti, Giles, is important on the Upper Digoel, New Guinea [R.A.E., B 25 257]. Its breeding places there were, however, at a distance from the places infested by the adults so that their elimination is not economic in so sparsely populated a district. In the island of Kabaena, C. fatigans was a vector of F. bancrofti, but artificial infection indicated capacity for transmission in other species, including A. barbirostris, Wulp., A. aconitus, Dön., C. fuscocephalus, Theo., C. whitmorei, Giles, and C. annulirostris, Skuse. Their relative importance is unknown, but it would be difficult to control them all.

F. malayi is transmitted by mosquitos of the subgenus Mansonioides of Mansonia and the Myzorhynchus group of Anopheles [25, 232, etc.]. In the Serajoe Delta, Java, species of Mansonioides appear to be the

sole vectors, and the eradication of *Pistia* has been advocated [23 23, etc.], but larvae of *Mansonia uniformis*, Theo., have since been found on other water-plants [25 195]. Even in areas where *A. barbirostris* is the sole vector, control by treating the breeding places would be difficult, as the larvae occur under a wide range of conditions. It is concluded that at present the prospects of combating filariasis are not encouraging, but further investigation is needed. It may be possible to eliminate the local factor, as yet unknown, that causes filariasis to give rise to elephantiasis.

Sweet (W. C.) & Pillai (V. Madhavan). Clearance of Pistia stratiotes as a Control Measure for F. malayi Infection.—Indian med. Gaz. 72 no. 12 pp. 730-734, 4 figs., 5 refs. Calcutta, December 1937.

As it was found that *Mansonia annulifera*, Theo., was the chief vector of *Filaria malayi* in a locality in Travancore [cf. R.A.E., B 21 23] and that its immature stages were associated with *Pistia stratiotes* [cf. 21 225; 23 238], it was suggested that filariasis might be controlled by the removal of *Pistia* from the numerous water collections. This work was begun late in 1933, but the first well-organised round of the area was not completed until April 1935; since that time 14 rounds have been made, and the 15th was begun in February 1937. Examination of children who were two years old and under and so had been born since the first complete round of *Pistia* removal had been completed showed no infection among 71 from the controlled area, but 11 infections among 56 from an uncontrolled area in the vicinity.

Schasekhar (E.). The Effect of reduced Pressure combined with increased Temperature on the viability of Bed Bugs and of their Eggs.—Indian med. Gaz. 72 no. 12 pp. 734-737, 1 fig., 1 ref. Calcutta, December 1937.

In connection with the control of Cimex hemiptera, F., in railway carriages in India [cf. R.A.E., B 22 70], further experiments were carried out in an apparatus, which is illustrated, to test the effect on the bugs and their eggs of increased temperature combined with reduced pressure. The period of exposure in all tests was 25 minutes. Adults exposed to 111·2°F. at a pressure of 15 inches of mercury all lived, whereas complete mortality of adults and eggs was caused by exposure to 116·6°F. both at the same pressure and at normal atmospheric pressure. It would thus appear that the pressure is of no importance. The necessity for investigating possible difficulties connected with the practical application of such temperatures to rolling stock is discussed.

[Tiburskaya (N. A.] Тибурская (H. A.). La plasmocide comme moyen gamétocide. [In Russian.]—Med. Parasitol. 6 no. 2 pp. 181-208, 51 refs. Moscow, 1937. (With a Summary in French.)

A detailed account is given of experiments in Russia to ascertain the minimum dose of plasmocide [cf. R.A.E., B 22 38], taken in the form of tablets in the course of a single day, that is required to render malaria patients uninfective to mosquitos for 24 hours, and the duration of the effect of such a dose. To ascertain the minimum dose, females of

Anopheles maculipennis, Mg., were fed on the patients before and 24 hours after treatment, and were then examined for occysts and sporozoites, a total of 1,876 individuals being dissected. In the case of Plasmodium vivax, a total dose of 0·12 gm. plasmocide in a day (0·03 gm. taken 4 times at intervals of 3–4 hours) completely prevented the infection of the mosquitos. Total doses of 0·09, 0·06 and 0·03 gm. reduced the average percentage of infected mosquitos from 32·5 to 3, 83·6 to 22 and 17·8 to 8·7, respectively. In the case of P. falciparum, total doses of 0·09 and 0·03 gm. in a day decreased the percentage of infected mosquitos from 35·1 and 57·1 to 1·5 and 8·6, respectively. With both species of Plasmodium, a marked reduction in the number of occysts in the mosquitos was usually observed [cf. loc. cit.]. In a single test with P. malariae, a total dose of 0·12 gm. prevented infection.

In the experiments to ascertain the duration of effect of the treatment, further batches of mosquitos were fed on some of the patients at 12-hour intervals from 36 to 108 hours after the last administration of the drug, a total of 2,265 mosquitos being dissected. In the case of $P.\ vivax$, one of two patients who received a total dose of 0.12 gm. remained uninfective for the whole 108 hours, but the other infected 3.7 per cent. of the mosquitos after 36 hours. The two patients who were given a dose of 0.09 gm. remained uninfective for 48 hours. In the case of $P.\ falciparum$, treatment for one day with a total dose of 0.09 gm. plasmocide followed by 15 doses of 0.1 gm. acrichin (a new synthetic drug that destroys the schizonts) during the next five days rendered the patients non-infective for the whole 108 hours.

On the basis of these investigations, the author suggests that all gametocyte-carriers should be treated with plasmocide at the rate of 0.09 gm. per day at intervals of two days. The treatment should continue for some time after the gametocytes have disappeared from the peripheral blood, since a case has been observed in which mosquitos were infected though no male gametocytes and only one female occurred to 500 leucocytes.

Legendre (J.). La suppression du moustique maritime.—La Nature 65 no. 2998 pp. 321–322, 2 figs. Paris, 1937.

A brief account is given of the breeding places in the coastal salt-marshes of Charente of Aëdes caspius, Pall. (punctatus, Mg.) [cf. R.A.E., B 24 157, etc.], which in this region has three generations a year. Suggestions are made for a partial reclamation of the area and the elimination of breeding places by preventing the entry of saltwater.

VAN HOOF (L.), HENRARD (C.) & PEEL (E.). Rôle du porc comme réservoir de Trypanosoma gambiense.—C. R. Soc. Biol. 126 no. 34 pp. 1245-1248, 1 ref. Paris, 1937.

In one of the experiments carried out in an investigation in the Belgian Congo on the part played by native pigs as a reservoir of Trypanosoma gambiense [R.A.E., B 26 32], it was observed that passage through the pig altered the morphology of the trypanosome and increased its arsenic resistance. This suggested that T. gambiense from man might be reduced by a change of habitat to a primitive T. brucei type that was not only biologically and morphologically

different but had also lost its power to infect man. To test, this hypothesis a strain of *T. gambiense* from man was transmitted by *Glossina* [palpalis, R.-D.] to three pigs in succession and then to a man, who subsequently developed sleeping sickness. Although it underwent some slight modifications in morphology and arsenic resistance, its power to infect man was unimpaired. These experiments confirm the fact that pigs are good reservoirs of the trypanosome that favour its development in the fly in spite of its rarity in the infecting blood [cf. loc. cit.].

VAN HOOF (L.), HENRARD (C.) & PEEL (E.). Influence de repas préliminaires indifférents sur l'evolution de Trypanosoma cazalboui chez Glossina palpalis.—C. R. Soc. Biol. 126 no. 34 pp. 1249—1252, 4 refs. Paris, 1937.

Previous experiments with Glossina palpalis, R.-D., and Trypanosoma gambiense [R.A.E., B 25 247] indicated that the numbers that become infected are far higher among freshly-emerged flies than among those that have previously taken one or more blood-meals on an uninfected animal. To account for this, the authors suggest that, for various reasons, the trypanosome can more easily establish itself in the extra-peritrophic space during the process of digestion of the first meal than at any other time. The process of development of T. vivax (cazalboui) is not so complicated, and experiments with this trypanosome, which are here described, indicate that meals taken prior to the infecting feed do not in any way affect its ability to develop in the salivary milieux of the proboscis. This result appears to be a further argument against the view that T. gambiense can establish itself directly in the salivary milieux of G. palpalis [cf. 26 31], and also helps to explain the high percentage of Glossina that becomes infected both naturally and experimentally with T. vivax.

Napier Bax (S.). The Senses of Smell and Sight in Glossina swynnertoni.—Bull. ent. Res. 28 pt. 4 pp. 539-582, 2 pls., 18 figs., 8 refs. London, December 1937.

A detailed account is given of experiments carried out in Tanganyika Territory in which the powers of sight and smell in *Glossina swynnertoni*, Aust., were tested to determine the actual distance at which it can smell and see under certain conditions.

The following is taken from the author's summary: Males in cages reacted at distances of 110 and 180 ft. but not at 300 ft. to the smell of oxen (which they could not see) passing to windward. Females reacted at 110 ft. but were not tested at greater distances. Human scent was found to be attractive, but there was evidence that the oxen, and not the men with them, were the main attraction. The scents of onion-scented bark rope, hessian and manure were tested at 110 ft. but were not attractive. There was evidence that the exhaust of a lorry at 300 ft. was attractive. The flies did not react to shouting, the trampling of oxen, or the noise of a lorry. Males reacted to the sight of oxen (passing on the leeward side of the cage to avoid any reaction to scent) at distances up to and including 450 ft. but not at a distance of 600 ft. Females reacted at 110 ft. but were not tested at greater distances. A maximum tonal contrast was obtained by using black oxen against a light background and carrying out the experiments in

bright sunshine; there was evidence that as the tonal contrast became less (through the sunshine being weak or the background being in semi-shadow), the distance at which the flies could see the oxen diminished. The reactions at 110 ft. were greatly reduced when a dark-blue background was used. At 110 ft. the reactions to a small dark screen were as good as those to a span of oxen.

Leeson (H. S.). The Mosquitos of the funestus Series in East Africa.
Bull. ent. Res. 28 pt. 4 pp. 587-603, 2 pls., 4 figs., 16 refs.

London, December 1937.

The following is taken from the author's summary of a study of Anophelines of the *funestus* series based on material collected in 1936 in Uganda, Tanganyika and on the Islands of Zanzibar and Pemba.

The species dealt with are Anopheles funestus, Giles (type form), A. rivulorum, Leeson, A. rivulorum var. garnhamellus, Evans & Leeson, and A. leesoni, Evans. Differences between the adults are so slight that they have, until recently, all been regarded as A. funestus. Differences between the larvae are much more pronounced. Keys to the adults and larvae are given. In East Africa at least, A. funestus reared from identical larvae and pupae has four main forms of wing pattern. A. rivulorum occurs in Uganda, but only two examples were taken in Tanganyika. A. rivulorum var. garnhamellus is widely distributed throughout East Africa. A. leesoni was found only in Uganda.

A. funestus, A. rivulorum and A. leesoni breed in similar situations, i.e., clear, shaded water with growing vegetation, particularly grass, in rivers, streams, pools and swamps. Light readings taken at the breeding places corroborated the many reports that these larvae prefer shaded situations and are absent from exposed waters. Larvae of A. rivulorum var. garnhamellus are usually associated with Pistia stratiotes, though they were found on at least two occasions where

this plant was absent.

No adults were taken outside buildings in spite of constant searching. Those taken inside were almost all A. funestus, the remaining few being A. rivulorum and A. rivulorum var. garnhamellus. At several places where adults of A. funestus were common in houses, very few or no larvae were found, although larvae of the other forms were present. It is therefore concluded that A. funestus is habitually a house-haunting species and that the others are not. Human blood alone was found in 239 out of 456 females of A. funestus tested, ox blood alone in 6, both in 7 and neither in 204. They were not tested for the blood of other animals. Of 122 females of the same species examined for malaria parasites, 15 were infected.

VELLARD (J.). Arthropodes vésicants ou piqueurs connus sous le nom de pitos dans les Andes vénézuéliennes.—Bull. Soc. Path. exot. 30 no. 10 pp. 878–884, 4 pls. Paris, 1937.

In the Andes in Venezuela, particularly in the temperate zone, numerous types of skin lesions of varying degrees of severity are attributed to "pitos." Investigations by the author showed that this name is applied to various Arthropods. The vesicant insects concerned are nearly all beetles and include a species of *Meloë*. The biting "pitos" comprise *Ornithodorus venezuelensis*, Brumpt, and a number of

Rhynchota, including the Triatomids, Rhodnius prolixus, Stål, Panstrongylus (Triatoma) geniculatus, Latr., and Eratyrus cuspidatus, Stål, and certain water bugs. The urticating insects examined were Lepidoptera of the genera Automeris or Megalopyge.

RAYNAL (J.). Contribution à l'étude des phlébotomes de la Chine du nord.—Arch. Inst. Pasteur Indochine 7 no. 25 pp. 37-99, 10 pls., 30 figs., 1 map, 7 pp. refs. Saigon, 1937.

The author describes in detail and gives keys to the adults of both sexes of Phlebotomus chinensis, Newst., P. sergenti var. mongolensis, Sinton, P. squamirostris, Newst., and P. khawi, Raynal, the species that are found in north China [cf. R.A.E., B 25 1, 128]. He discusses their synonymy and reviews data from the literature on their biology, their distribution in north China and the question of their relation to visceral leishmaniasis, suggesting that P. chinensis probably transmits the disease and that the other species do not. He reports that Y. T. Yao, C. C. Wu and C. J. Sun found microfilariae in the stomachs of eight examples of P. chinensis, P. sergenti var. mongolensis and another species of Phlebotomus captured in nature in north Kiangsu. They also obtained 17 positive results in an experiment in which 59 examples of P. sergenti var. mongolensis were fed on a patient infected with Filaria (Wuchereria) bancrofti. The sandflies were dissected at intervals of several days and microfilariae were found in all stages of development up to the sausage-shaped forms in the thoracic muscles; the infecting forms were not seen owing to the premature deaths of the sandflies.

NÁJERA ANGULO (L.). Sur les phlébotomes de l'Espagne.—C. R. XIIe. Congr. int. Zool. Lisbonne 1935 2 pp. 1481-1494, 1 pl., 23 refs. Lisbon, 1937.

Notes are given on the morphology and distribution of species of *Phlebotomus* found in Spain [cf. R.A.E., B **23** 280; **24** 213]. Among examples of *P. perniciosus*, Newst., collected at Sigüenza were found specimens that the author refers to *P. tobbi*, Adl., Thdr. & Lour. The specimens previously recorded as *P. parroti*, Adl. & Thdr., are stated to be var. *italicus*, Adl. & Thdr.

CAMBOURNAC (F.). Les culicides de Aguas-de-Moura.—C. R. XIIe. Congr. int. Zool. Lisbonne 1935 2 pp. 1499-1508, 6 refs. Lisbon, 1937

Notes are given on the characters and habitats of the adults and larvae of the mosquitos collected in the vicinity of Aguas-de-Moura, Portugal, which included *Anopheles maculipennis* var. *atroparvus*, van Thiel.

GIL COLLADO (J.). Quelques considerations sur les gîtes larvaires des culicides espagnols.—C. R. XIIe. Congr. int. Zool. Lisbonne 1935 3 pp. 2065–2078. Lisbon, 1937.

The author gives notes on the species of mosquitos breeding in all types of domestic and natural collections of water in Spain and discusses the influence of various factors characteristic of the different breeding places on their mosquito fauna.

DE CARVALHO DIAS (A.). Sur la distribution au Portugal d'Ornithodorus erraticus agent de transmission de la fièvre récurrente hispano-africaine.—C. R. XIIe. Congr. int. Zool. Lisbonne 1935 3 pp. 2079–2083, 1 fig., 5 refs. Lisbon, 1937.

Records are given of the occurrence of *Ornithodorus erraticus*, Lucas, in the eastern provinces of Portugal south of the Tagus. Laboratory experiments demonstrated infection with *Spirochaela hispanica* in one lot of ticks from the commune of Barrancos.

MALAMOS (B.). Versuche mit Leishmanien. IV. Versuche der Kala-Azar Uebertragung durch Zecken (Rhipicephalus sanguineus). [Experiments with Leishmania. IV. Experiments in the Transmission of Kala-azar by Ticks, R. sanguineus.]—Arch. Schiffs- u. Tropenhyg. 42 pt. 1 pp. 22–23, 7 refs. Leipzig, January 1938.

In experiments at Hamburg several hundred larvae and nymphs of *Rhipicephalus sanguineus*, Latr., were allowed to engorge on hamsters infected with visceral leishmaniasis. No leishmania bodies or flagellates were found in the ticks dissected, nor did hamsters injected interperitoneally with crushed ticks acquire infection.

Eichler (W.). Wo kommt die Mehlschwalbenlaussliege vor? [Where does Stenepteryx hirundinis, L., occur?]—Mitt. Ver. sächs. Orn. 5 pt. 3 pp. 126–130, 2 figs., 5 refs. Dresden, April 1937. [Reed. December 1937.]

The author discusses briefly the distribution in Germany of Stenepteryx hirundinis, L., of which the house martin is the chief host, though swallows and swifts are occasionally attacked. A key is given to the 11 Hippoboscids recorded in Germany.

Weidner (H.). Bestimmungstabellen der Vorratsschädlinge und des Hausungeziefers Mitteleuropas. [Keys to the Store Pests and Household Vermin in Central Europe.]—Med. 8vo, xvi + 144 pp., 171 figs. Jena, G. Fischer, 1937. Price paper M. 6·50, cloth M. 7·70.

The bulk of this work (pp. 8-124) consists of a key to the various Arthropods, their identification being based on morphological characters, supplemented in some cases by notes on habitat or food. Indices are given to the scientific and popular names of the pests, and to their characteristic habitats and foodstuffs.

Gough (H. C.). Use of Sulphur Dioxide against the Bedbug.—Nature 141 no. 3560 p. 164, 4 refs. London, 22nd January 1938.

A summary is given of the results of experiments to determine the relative resistance of different stages of *Cimex lectularius*, L., to fumigation with sulphur dioxide. The amounts in mg. per litre necessary to give complete mortality at 23° C. [$73\cdot4^{\circ}$ F.] and 60 per cent. relative humidity were from $16\cdot7$ to $8\cdot9$ for eggs (the susceptibility of which increased with age), $5\cdot7$ – $6\cdot2$ for nymphs (tested in all instars), and $4\cdot2$ for adults two days after the first meal.

BACK (E. A.). Cockroaches and their Control.—Leafl. U.S. Dep. Agric.

no. 144, 6 pp., 5 figs. Washington, D.C., 1937.

BACK (E. A.). The increasing Importance of the Cockroach, Supella supellectilium, Serv., as a Pest in the United States.—Proc. ont. Soc. Wash. 39 no. 8 pp. 207-213, 2 pls., 2 figs., 8 refs. Washington, D.C., November 1937.

In the first paper, a brief popular account is given of the appearance and habits of *Periplaneta americana*, L., *P. australasiae*, F., *Blatta orientalis*, L., *Blattella germanica*, L., and *Supella supellectilium*, Serv., the cockroaches that are frequently troublesome household pests in the United States. The measures of control recommended include filling all cracks through which the cockroaches may escape from their hiding places, with putty, plastic wood or plaster of Paris, dusting the places they frequent with sodium fluoride or pyrethrum powder, placing cylinders of rolled-up cardboard smeared inside with phosphorus paste behind books, inside drawers or in the framework of upholstered furniture, and applying direct to the cockroaches sprays consisting largely of pyrethrum extract and kerosene.

The second paper was written to call attention to the increasing importance of *S. supellectilium*, a cosmopolitan cockroach of tropical countries that has now become established in cities in the United States [cf. R.A.E., A 17 453]. A list is given of the localities from which it has been recorded. The ootheca, nymph and adult are

described and compared with those of B. germanica.

Mohler (J. R.). Report of the Chief of the Bureau of Animal Industry, 19°36-37.—64 pp. Washington, D.C., U.S. Dep. Agric., 1937.

As a result of continued progress in the campaign for the eradication of the cattle fever tick [Boophilus annulatus, Say] in the United States, the area under Federal Quarantine is now only 5 per cent. of its original size and is confined to parts of Florida and Texas [cf. R.A.E., B 24 84]. Anaplasmosis was not transmitted to susceptible cattle by nymphs of Rhipicephalus sanguineus, Latr., reared from larvae that had engorged on a recovered carrier, or by adults of this species or of Dermacentor venustus, Banks (andersoni, Stiles) that had been fed as larvae and nymphs on rabbits and were the offspring of adults that had engorged on a recovered carrier.

In November 1936, about 6,650 range sheep were treated with 3 per cent. lysol solution at the rate of 2 oz. per animal for the control of *Ocstrus ovis*, L. [cf. **25** 127]; the results, although incomplete, indicate that a single treatment reduced infestation by about 80 per

cent.

MORRISON (F. O.). Myiasis in the Foot of a Rat by Wohlfahrtia meigenii Schiner. (Diptera, Metopiidae).—Canad. Ent. 69 no. 12 pp. 266–269, 9 refs. Orillia, December 1937.

Cases of myiasis in man have been recorded on various occasions from a number of widely scattered localities in Alberta, but in most instances the larvae obtained from them were placed in alcohol when they were too immature for identification. Several cases are briefly described; one was thought to be due to Wohlfahrtia meigeni, Schin., and another to an unidentified species of Sarcophaga. Details are given of an infestation in the foot of a rat by a larva from which a large fly was reared. This was determined as Wohlfahrtia meigeni, since

it was not sufficiently dark to be ascribed to W. vigil, Wlk., which up to the present is not definitely known to occur in western Canada [cf. R.A.E., B 20 47]. Although all specimens of Wohlfahrtia taken in western Canada have been identified as W. meigeni, a species that occurs in Europe and Asia, the rate of development and the habits of the larvae, as well as the habits of the adults, are very similar to those of W. vigil. W. meigeni is said to breed in carrion in Europe, and it is suggested that it does not occur in western Canada and that the flies identified as it are probably a geographical variety of W. vigil.

PAPERS NOTICED BY TITLE ONLY.

- Mackerras (I. M.). Notes on Australian Mosquitoes (Diptera, Culicidae). Part III. The Genus Aëdomyia Theobald.—Proc. Linn. Soc. N.S.W. 62 pt. 5-6 pp. 259-262, 5 figs., 7 refs. Sydney, 1937. [Cf. R.A.E., B 16 29.]
- Lee (J. D.). Notes on Australian Mosquitoes (Diptera, Culicidae).

 Part IV. The Genus Theobaldia, with Description of a new Species.

 —Proc. Linn. Soc. N.S.W 62 pt. 5-6 pp. 294-298, 9 figs., 6 refs. Sydney, 1937.
- Shields (S. E.) & Miles (V. I.). The Occurrence of Orthopodomyia alba in Alabama (Diptera: Culicidae).—Proc. ent. Soc. Wash. 39 no. 8 p. 237. Washington, D.C., November 1937.
- Komp (W. H. W.). The Nomenclature of the Thoracic Sclerites in the Culicidae, and their Setae.—Proc. ent. Soc. Wash. 39 no. 9 pp. 241-252, 2 figs., 13 refs. Washington, D.C., December 1937.
- GJULLIN (C. M.). The Female Genitalia of the Aëdes Mosquitoes of the Pacific Coast States.—Proc. ent. Soc. Wash. 39 no. 9 pp. 252-266, 22 figs., 5 refs. Washington, D.C., December 1937.
- DA SILVA RAMOS (A.). **Descripção do macho de** Nyssorhynchus (Myzorhynchella) lutzi, (**Cruz, 1901**). [Description of the Male of Anopheles lutzi, Cruz.]—Rev. Ass. paulista Med. **11** no. 2 pp. 78–84, 3 figs. São Paulo, August 1937. [Recd. December 1937.]
- Chou (Ta Wei). Studies on the Morphological Variations in Anopheles (Myzomyia) pattoni, Christophers, 1926.—Lingnan Sci. J. 16 no. 4 pp. 543–550, 3 figs., 5 refs. Canton, 6th December 1937.
- [Sokolov (N. P.).] Cohonob (H. II.). Combined Application of chemical and biological Methods of Control against Anopheline Larvae fa review of the literature]. [In Russian.]—Sotz. Nauka Tekh. 5 no. 5 pp. 111-114. Tashkent, May 1937. [Recd. February 1938.]
- MALTBAEK (J.).

 Mallophaga.

 Ent. Medd.

 Danske Lus og Pelslus. [Danish Anoplura and Keys to Genera and Lists of Species with Hosts.]—

 Ent. Medd.

 20 no. 1 pp. 1–19, 6 figs., 5 refs. Copenhagen,
 December 1937.
- Werneck (F. L.). Algumas especies e subespecies novas de Anoplura. Some new Species and Subspecies of Anoplura.]—Mem. Inst. Osw. Cruz 32 pt. 3 pp. 391-410, 20 figs., 3 pls. Rio de Janeiro, 1937.

- DA COSTA LIMA (A.). Chave das especies de Culicoides da região neotropica (Diptera: Ceratopogonidae). [A Key to the Species of Culicoides of the Neotropical Region (including two new species from Brazil).]—Mem. Inst. Osw. Cruz 32 pt. 3 pp. 411-422, 6 figs., 10 refs. Rio de Janeiro, 1937.
- ROY (D. N.) & MUKHERJEE (P. K.). Allantonema muscae sp. nov., a new parasitic Nematode of the Family Rhabditidae from the Haemocoele of Musca [domestica] vicina.—Ann. trop. Med. Parasit. 31 no. 4 pp. 449-451, 1 fig., 2 refs. Liverpool, 21st December 1937. Allantonema stricklandi sp. nov., a parasitic Nematode of House-flies, Musca [domestica] vicina.—T.c. pp. 453-456, 1 fig., 2 refs.
- MACFIE (J. W. S.). Three new Species of Culicoides (Diptera, Ceratopogonidae) from Malaya.—Ann. trop. Med. Parasit. 31 no. 4 pp. 469-472, 2 figs. Liverpool, 21st December 1937.
- Tokunaga (M.). Supplementary Report on Japanese Sand Flies (Ceratopogonidae, Diptera) [including a new species of Lasiohelea. —Tenthredo 1 no. 4 pp. 455–459, 1 pl., 3 refs. Shinomyia, Yamashina, Kyoto, November 1937. [Cf. R.A.E., B 25 255.]
- Eichler (W.). Die Vogelparasiten. Eine Uebersicht über die verschiedenen Gruppen. II. Die Vogelblutmaden. [Bird Parasites. A Review of the different Groups. II. The Blood-sucking Maggots of Birds.]—Orn. Mschr. 41 no. 7-8, pp. 116-120, 15 refs. Magdeburg, 1936. [Recd. December 1937.]
- Turner (N.) & Walden (B. H.). Some common Household Insects [in Connecticut] and their Control.—Bull. Conn. agric. Exp. Sta. no. 400 pp. 835–855, 13 figs., 12 refs. New Haven, Conn., September 1937.
- Waterston (J.). Fleas as a Menace to Man and Domestic Animals. Their Life-history, Habits and Control.—Econ. Ser. Brit. Mus. (Nat. Hist.) no. 3, 4th edn revd by P. A. Buxton, 20 pp., 6 figs., 2 refs. London, 1937. Price 4d. [Cf. R.A.E., B 4 166.]
- DA FONSECA (F.). Flebotomus [Phlebotomus] limai, n.sp.—C. R. XIIe. Congr. int. Zool. Lisbonne 1935 2 pp. 1497–1498, 3 figs. Lisbon, 1937. [Cf. R.A.E., B 25 240.]
- SEN (Sisir). On the Mechanism of Feeding in Blood-sucking Acari [ticks], and its Relationship with that of Blood-sucking Diptera. C. R. XIIe. Congr. int. Zool. Lisbonne 1935 3 pp. 1584-1587, 2 figs., 3 refs. Lisbon, 1937.
- DE BUEN (S.). Sur le parasitisme de Treponema [Spirochaeta] hispanicum dans Ornithodorus erraticus. (Note préliminaire.)—C. R. XIIe. Congr. int. Zool. Lisbonne 1935 3 pp. 1884–1887, 1 ref. Lisbon, 1937. [Cf. R.A.E., B 24 277.]
- STEFANSKI (W.). La distribution de l'hypoderme du boeuf en Pologne.

 —C. R. XIIe. Congr. int. Zool. Lisbonne 1935 3 pp. 2057-2060.

 Lisbon, 1937. [Cf. R.A.E., B 23 170.]
- HASSALL (A.), POTTER (M.), DOSS (M. A.), FARR (M. M.) & CARSON (G. B.). Index-catalogue of Medical and Veterinary Zoology. Part 2. Authors: B to Bychkov.—pp. 143–612. Washington, D.C., U.S. Dep. Agric., 1938. Price 55 cts. (from Supt. Documents). [Cf. R.A.E., B 21 176.]

Hungerford (T. G.) & Hart (L.). Fowl Tick Fever (Spirochaetosis) also transmitted by Common Red Mite.—Agric. Gaz. N.S.W. 48 pt. 10 pp. 591-592, 1 fig. Sydney, 1st October 1937.

Until recently, spirochaetosis of fowls, which is caused by Spirochaeta (Treponema) anserina (gallinarum), was thought to be transmitted in New South Wales solely by Argas persicus, Oken. During the last two years, however, three outbreaks have occurred in which Dermanyssus gallinae, DeG. (avium, Dugès) was suspected of being the vector. In another outbreak, which is described, A. persicus was absent and the number of new cases occurring suddenly decreased 4 days after a thorough spraying with kerosene emulsion had been undertaken to destroy D. gallinae, which was abundant. To test the ability of the mites to transmit the disease, two healthy fowls were placed in a fly-proof room in a box containing two infected birds and large numbers of mites; both became infected.

Davidson (J.). The Temperature-Development Curve of Lyperosia exigua de Meijere (Diptera, Muscidae) in Relation to the probable Distribution of this Insect in Australia.—Aust. J. exp. Biol. med. Sci. 15 pt. 2 pp. 113–120, 8 refs. Adelaide, June 1937.

The author discusses information contained in papers by Tillyard, Handschin, and Windred [R.A.E., B 20 46, 258; 21 257, 270 etc.] on Lyperosia exigua, de Meij., and considers that the data on which they base their conclusions regarding the possible limits of its spread in Australia are insufficient, so that these limits are not adequately defined. The effect of climate in determining its ultimate distribution in Australia may be interpreted in terms of the monthly ratio of precipitation: evaporation and temperature [cf. A 24 196; 25 450]. Low rainfall limits its spread into the inland areas of the continent. Northern Australia is favourable for it owing to the summer rainfall system. In the southern regions with a winter rainfall system, temperature is unfavourable in winter when the rainfall is adequate and low rainfall in summer when the temperatures are favourable. In the eastern coastal belt and in the extreme southern parts of the continent, where moisture (rainfall) is adequate for the greater part of the year, temperature becomes the limiting factor; the southern boundary of ultimate distribution in the eastern coastal belt cannot be determined from the available data.

Mackerras (I. M.) & Fuller (M. E.). A Survey of the Australian Sheep Blowflies.—J. Coun. Sci. industr. Res. Aust. 10 no. 4 pp. 261–270, 12 refs. Melbourne, November 1937.

The results are recorded of surveys of blowfly strike in sheep carried out in Australia during recent years, the conclusions from which have been stated in previous publications [cf. R.A.E., B 25 78, 130; etc.]. Examination of 1,691 strikes from all parts of the country where sheep are raised shows that Lucilia cuprina, Wied., is the most important and widespread blowfly in Australia. Species of Calliphora, especially C. nociva, Hardy, are responsible for about one-fifth of the strikes, chiefly in the southern districts, but Lucilia sericata, Mg., is of no practical importance. It has been demonstrated that there is a succession of species attacking living sheep parallel to that infesting (821) Wt. P9/3656 1600 5/38 S.E.R. Ltd. Gp. 353. [8]

carrion [cf. 22 260]. In one experiment, apparently susceptible sheep were kept for several days in the insectary with a number of examples of L. sericata, but no strikes developed until after a few examples of L. cuprina had been introduced. Examination showed that the infestations were due to maggots of both species of the same age; thus it would appear that oviposition by L. cuprina stimulated oviposition by L. sericata. Larvae of Chrysomyia micropogon, Big., or of Sarcophaga spp. have been found occasionally in association with those of L. cuprina in rather older strikes; they have never been seen alone or in very recent strikes. Many of the records of Chrysomyia rufifacies, Macq., and a few of C. (Microcalliphora) varipes, Macq., were from pockets at the edges of advanced, extensive strikes of several days' duration that were still crowded with all stages of primary maggots, particularly those of L. cuprina. Most of the other records of C. rufifacies were from similar pockets in rather more advanced strikes, in which only a few maggots of Lucilia in the prepupal stage, or no primary maggots, were present. In the healing edges of old strikes, and particularly under scabs, small infestations with young primary maggots are fairly common. Larvae of Peronia rostrata, R.-D., Musca hilli, J. & B., and M. domestica, L., have never been found invading the skin, but are usually found in the dead, matted, almost dry wool that has lifted from old strikes.

Lee (D. J.). A Laboratory Method for testing Tropisms of Blowflies.—

J. Coun. sci. industr. Res. Aust. 10 no. 4 pp. 271-274, 1 fig. Melbourne, November 1937.

The author describes stages in the evolution of an olfactometer for measuring the tropisms of Lucilia cuprina, Wied. The apparatus was designed to permit freedom of flight for the flies, provide equal illumination for all parts of the cage, and reduce chance catches in empty traps to a minimum. The final result was a cage $(30 \times 30 \times 30)$ inches) having sides of double-thickness black voile and a wooden top with 16 equidistant holes $2\frac{1}{2}$ inches in diameter arranged in a square. In each hole was inserted the mouth of a trap consisting of an inverted glass beaker fitted with a cone of perforated celluloid; a disk of iron with a diameter larger than the opening was fixed a short distance below it to prevent light entering from below and so reduce escape from the traps. Fixed on a support in the centre of the cage was a 60-watt, gas-filled, electric light bulb; the light not only tended to retain the flies in the cage and so reduce chance entry into the traps but also kept them in more or less constant flight. The substance to be tested was placed on a muslin screen held in place by a cylinder of perforated celluloid that fitted closely into the beaker.

Lee (D. J.). A Note on the Colour Responses of Lucilia cuprina.—J. Coun. sci. industr. Res. Aust. 10 no. 4 pp. 275–276. Melbourne, November 1937.

Tests with the tropometer described in the preceding paper were carried out to determine the responses of *Lucilia cuprina*, Wied., to different colours. The cage, without internal illumination, was placed directly under the standard ceiling light, and the glass traps were covered with sheets of blue, green, yellow or pink cellophane, the intensity of the light transmitted by the different colours being

approximately equalised by using a different number of sheets for each colour. Yellow, blue, pink and green appeared to be attractive in that order.

MACLEOD (J.). The Species of Diptera concerned in Cutaneous Myiasis of Sheep in Britain.—Proc. R. ent. Soc. Lond. (A) 12 pt. 10-12 pp. 127-133, 10 refs. London, 15th December 1937.

The following is the author's summary: A study of the flies concerned in sheep strike has confirmed the finding of Haddow and Thomson [R.A.E., B 25 134] that species other than Lucilia sericata, Mg., may occasionally strike sheep. These alternative species were found to occur frequently in Scotland (27 out of 68 cases) and they must therefore be regarded as important. They occur rather less frequently in England. Three alternative species are recorded from Scotland, L. caesar, L., Calliphora erythrocephala, Mg., and Phormia terraenovae, R.-D.; the first two of these were also obtained in England. L. caesar was found to be a more commonly occurring species than C. erythrocephala. P. terraenovae appears to be confined to western Scotland [cf. 25 11], and to occur only in the early part of the season. Experimental and inferential evidence is given in support of the contention that L. caesar and P. terraenovae belong to the category of primary striking flies, whilst C. erythrocephala is a true secondary striking fly. C. vomitoria, L., is held to be, at most, a tertiary striking fly.

Freney (M. R.). Studies on the Chemotropic Behaviour of Sheep Blowflies.—Pamphl. Coun. sci. industr. Res. Aust. no. 74, 24 pp., 1 pl., 3 graphs., 15 refs. Melbourne, 1937.

In this paper are given the results of experiments carried out as part of an uncompleted investigation on the chemotropic responses of sheep blowflies in Australia. The substances to be tested were exposed in the open in traps, and their attractiveness was estimated by the

number of flies caught.

The following is taken largely from the author's summary: Various pure chemicals, including many known to be formed during putrefaction, were tested, but only ethyl mercaptan was attractive, both primary and secondary flies being caught in traps baited with it. Minced tissues of various organs, such as liver, kidney, brain, etc., were tested, but none was specifically attractive to primary flies. When mixtures of minced liver and small amounts of selected chemicals were used, it was noted that alkaline sulphides and neutral or slightly alkaline buffering agents enhanced the attractiveness of carrion to all species of flies, and that poisons, preservatives and protein precipitants prevented carrion from becoming attractive. The addition of small amounts of calcium carbonate to carrion not only increased its attractiveness to flies, but also increased the amount of volatile sulphur compounds subsequently evolved. Larger numbers of flies were caught when sodium sulphide or calcium sulphide was added to carrion baits than when the latter were used alone. The attractiveness of putrefying spleen was enhanced when its odours were mingled with those of acetic acid; certain results suggest that hydrogen sulphide may have a similar effect. The odours of putrefying spleen were more attractive alone than when mixed with that of chlorine or iodine. No highly attractive substances were obtained when attractive carrion baits were distilled or when such baits were extracted with organic solvents. Fresh egg yolk and egg white, neither of which are attractive to flies, become attractive if hydrolysed with sodium sulphide solution. When the chief constituents of egg yolk were hydrolysed with this substance, the attractiveness of the oil was only slightly enhanced, but that of lecithin and vitellin was more so. Preparations from the skin and excreta of sheep were not attractive to flies; "struck" fleece appeared to be only slightly attractive.

NATVIG (L. R.). Om kubremsene og deres optreden i Norge. [On Ox Warble-flies and their Occurrence in Norway.]—Norsk Vet.-Tidsskr. 49 nos. 5–10 repr. 184 pp., 24 figs., 174 refs. Oslo, 1937. (With a Summary in English.)

This paper on the distribution and biology of the warble-flies (*Hypoderma*) in Norway is based on information from some 250 correspondents in addition to published records. It is preceded by notes from the world literature on the history, distribution, economic importance and control of these flies, and the systematic characters and biology of all stages. *Hypoderma lineatum*, Vill., appears to be far more common in Norway than *H. bovis*, DeG., but it has not always been possible to

differentiate the larvae [see next abstract].

Second-instar larvae were collected from 10th March to 13th May, the majority occurring in April, and third-instar larvae from 24th March to 15th July, the majority occurring in May and early June. Dead larvae were occasionally found in the backs of cattle up to the following February. The character of the pastures greatly influenced the distribution and abundance of the flies, which apparently prefer more or less open woodland. There were some reports that cattle on southern slopes are more exposed to attack than those on northern slopes and that the flies are more abundant in somewhat damp and swampy places. Reports from southern Norway indicated that they do not occur in the mountains, and no infestation has been observed further north than Vefsen in the county of Nordland. The flies are rare, if they ever occur, on pastures exposed to wind along the coast or on islands. The reports agreed that calves and young animals have a higher percentage of infestation, and that animals in poor condition are usually more heavily infested than healthy ones. Most correspondents held that animals of bright colour were preferred, but some considered that dark ones were. It was stated that in some districts up to 50 per cent. of the animals may be infested.

There appears to be a striking and distinct decrease in the distribution and abundance of *Hypoderma* in Norway as compared with the period 1875–1920. Cattle are now released later in the spring, and are often stabled during the hot time of day in the season of fly activity. Various washes, including derris, and ointments are used, and the larvae are extracted by hand in many districts. The flies decrease in years following cold, wet summers, and in the more northern area of their distribution they seem to have been totally exterminated in

unfavourable years.

There is a considerable amount of evidence that *Cephenomyia trompe*, Modeer, which infests reindeer in parts of Norway, sometimes places its larvae in the nostrils of cattle and that the larvae cause irritation, though it is not known whether they complete development.

NATVIG (L. R.). **Ueber die Differentialdiagnose der Larven von** *Hypoderma bovis* **und** *H. lineatum*. [On the Differentiation of the Larvae of *H. bovis* and *H. lineatum*.]—*Festschr. Nocht* 1937 pp. 386–393, 4 figs., 21 refs. Hamburg, 1937.

The author finds that with Norwegian material there may be difficulty in differentiating larvae of *Hypoderma lineatum*, Vill., from those of *H. bovis*, DeG., by characters of the posterior stigmal plates [cf. R.A.E., B **9** 171]. He discusses these characters and the mouth-parts as aids to identification.

NAČEV (B.). Kliničeski izsledvanija v'rhu gastrofiliazata na konetě.

[Clinical Investigations on Gastrophilus Infestation in Horses.]—

Annu. Univ. Sofia 9 pp. 531-567, 10 figs., 16 refs. Sofia, 1936.

(With a Summary in German.) (Abstr. in Vet. Bull. 8 no. 2 p. 96. Weybridge, February 1938.)

Five species of Gastrophilus occur in horses in Bulgaria, G. intestinalis, DeG. (equi Cl.), G. haemorrhoidalis, L., G. pecorum, F., G. nasalis, L., and G. inermis, Brauer [cf. R.A.E., B 20 206; 21 251]. Larvae were found in 48 out of 72 aged horses slaughtered for the purpose of feeding animals in the Sofia Zoological Gardens. They were also found commonly in horses used in field work; but rarely in others.

BARRETT, jr. (W. L.). Natural Dispersion of Cochliomyia americana.—
J. econ. Ent. 30 no. 6 pp. 873–876, 4 refs. Menasha, Wis.,
December 1937.

Cochliomyia hominivorax, Coq. (americana, Cush. & Patt.) does not survive the winter months in parts of the United States in which low temperatures occur, but every summer areas far beyond the northern limit of winter survival become infested. In this paper are given the results of observations made during the spring and summer of 1936 on

the natural rate of dispersion into these areas.

The following is taken from the author's summary and conclusions: The appearance of the adult flies and the occurrence of cases of infestation on successive dates in previously uninfested areas progressively farther away from the overwintering zone, without any close relation to livestock shipment, indicate that the movement of the pest toward the north in the area under observation was by natural migration. From 5th March to 1st August, it evidently migrated from Uvalde on the northern boundary line of the overwintering area in southern Texas to Buffalo, Oklahoma, near the boundary of Kansas. The average weekly rate of dispersion (after the advent of continuously warm weather) was about 35.4 miles towards the north and about 20.3 miles towards the north-east. The rate of spread towards the east was much slower. At times, however, the rate of weekly dispersion to the north apparently exceeded the average by 15 miles. The rate at which the fly dispersed shows that, under favourable conditions, areas about 1,500 miles from the northern edge of the overwintering zone may become infested as a result of seasonal spread. The fly appears to disperse readily even from areas in which the population of the species is low. (821) [B]

McGovran (E. R.). Insecticides to Control Blowfly Larvae in Wounds.

—J. econ. Ent. 30 no. 6 pp. 876–879, 5 refs. Menasha, Wis.,

December 1937.

The experiments described were undertaken at Valdosta, Georgia, with a view to discovering a larvicide for use in wounds infested with larvae of Cochliomyia hominivorax, Coq. (americana, Cush. & Patt.) that could be applied more rapidly than benzol and with less manipulation of the wound. The animals used were sheep and goats; the technique employed is described in detail. Satisfactory results (over 99 per cent. control) were obtained by pouring into the wound 98 per cent. of a soluble pine-tar oil plus 2 per cent. methyl thiocyanate, 98 per cent. of a second pine-tar oil plus 2 per cent. of 95 per cent. nicotine, or a commercial brand of benzol containing more than 90 per cent. benzene held in the wound by means of a cotton wool plug, but not by using the benzol without a plug or applying the pine-tar oils alone. The first soluble pine-tar oil consisted of 75 per cent. of a pine-tar oil of which 90 per cent. distilled between 199 and 216°C., and 25 per cent. sulphonated castor oil neutralised with ammonium hydroxide. The second consisted of 75 per cent. of a pine-tar oil of which 90 per cent. distilled between 115 and 210°C., that had been oxidised and the acid formed neutralised, and 25 per cent. sulphonated castor oil neutralised with ammonium hydroxide.

Simanton (W. A.) & Miller (A. C.). Housefly Age as a Factor in Susceptibility to Pyrethrum Sprays.—J. econ. Ent. 30 no. 6 pp. 917–921, 1 fig., 6 refs. Menasha, Wis., December 1937.

In the modern application of the Peet-Grady method of estimating the effectiveness of insecticides by tests on *Musca domestica*, L. [cf. R.A.E., B **16** 255], it is specified that the flies used should be 5 days old. As flies from 2 to 6 days old are often used, tests were conducted to demonstrate the extent to which the age of the flies affects their susceptibility to a pyrethrum spray. Variability in resistance to insecticides appeared to be greatest during the ages at which pairing and oviposition occur. Very young flies were more easily paralysed, but much less easily killed than older flies. The difference in resistance between male and female flies increased between the ages of 6 and 45 hours. Among flies 3 to 5 days old, the females were about twice as resistant as the males; they were also more difficult to paralyse.

STAGE (H. H.), GJULLIN (C. M.) & YATES (W. W.). Flight Range and Longevity of Flood-water Mosquitoes in the Lower Columbia River Valley.—J. econ. Ent. 30 no. 6 pp. 940–945, 5 figs. Menasha, Wis., December 1937.

Details are given of observations on the flight range and longevity of Aëdes vexans, Mg., and A. lateralis, Mg. (aldrichi, D. & K.) during the years 1930–36.

ESKEY (C. R.). Recent Developments in our Knowledge of Plague Transmission.—Publ. Hlth Rep. 53 no. 2 pp. 49–57. Washington, D.C., 14th January 1938.

There is a widespread belief that plague is very likely to be transmitted by the bites of almost any flea that has fed on an infected

animal, but a comparison of epizootics and epidemics shows that their persistence and severity have varied greatly according to climatic conditions, which have great influence in determining the prevalence of different species of fleas on rats but little effect on human susceptibility to the disease or the density of the rat population of cities. That the intensity of epidemics is regulated by the species rather than the total number of fleas present on rats in a community is illustrated by the course of outbreaks in San Francisco, California, and Guayaquil, Ecuador. Surveys have shown that the rats of San Francisco harbour an average of 7 fleas per animal, or about 2 more than are found on those in Guayaquil, yet only 278 cases of plague were reported in the former city during 7 years, whereas an average of 364 cases occurred annually in the latter during the 22 years that the disease was continuously present. Only Xenopsylla cheopis, Roths., was found on rats in Guayaquil, whereas in San Francisco the rats also harboured Ceratophyllus (Nosopsyllus) fasciatus, Bosc, and Leptopsylla (Ctenopsyllus) segnis, Schönh., and the cheopis index was only about half that in Guayaquil.

During 1937, investigations were carried out in San Francisco of the susceptibility to infection, when fed on plague-infected guineapigs, of these three rat fleas and of five species from wild rodents, and also their ability to transmit the disease to healthy guineapigs by biting.

X. cheopis was found to be much more susceptible to infection than any of the other fleas, 66 per cent. becoming infected as compared with about 25 per cent. of Ceratophyllus (Diamanus) montanus, Baker, and Hoplopsyllus anomalus, Baker, from California ground squirrels [Citellus beechyi], fleas from desert antelope ground squirrels [Ammospermophilus leucurus] and Ceratophyllus fasciatus, about 10 per cent. of Leptopsylla segnis and fleas from Peromyscus, and none of 24 examples of Ceratophyllus (Oropsylla) idahoensis, Baker. C. idahoensis, which was taken from Citellus beldingi, has frequently been found associated with other fleas on ground squirrels in several states and has been recorded from regions where plague foci exist.

Twenty guineapigs died of plague following the bites of fleas that had fed on plague-infected guineapigs, 16 being infected by X. cheopis, 2 by C. fasciatus, and one each by C. montanus and H. anomalus. Except in the case of X. cheopis and C. montanus, there were insufficient numbers of infected fleas of each species to justify definite conclusions regarding their abilities to transmit plague by biting. Only 9 of 32 infected examples of X. cheopis transmitted the disease; one of them infected 5 animals, of which 3 were infected on 3 successive days, and another 3 guineapigs in 1 day. Had the infected fleas been allowed to feed more frequently they would have caused more infections, because once they are capable of transmitting plague they will infect an animal practically every time they insert the proboscis. Transmissions by C. fasciatus were effected by two fleas out of only five known to have been infected; these two fleas would not feed again. Only one of 12 infected examples of C. montanus transmitted the disease.

In every case in which the bites were infectious, except in the one of transmission by *H. anomalus*, it was observed that, although the feeding period was longer than usual, no blood entered the stomach; infected fleas that did not show this evidence of blockage did not transmit infection. Even some of the blocked fleas failed to transmit infection (12 examples of *X. cheopis* were unable to suck blood, but only 9 were vectors), and it is possible that, owing to their weakened condition,

their efforts were not strong enough to cause regurgitation. Obstruction in X. cheopis was observed between the 9th and 26th day after the infecting feed; those kept at over 70°F. became blocked earlier than those kept at about 60°F., which suggests that increased temperatures accelerate the multiplication of the plague bacillus in the proventriculus of this flea. A much longer period elapsed before the bites of the other species were infective; the periods for H. anomalus, C. fasciatus, and C. montanus being 35, 55 and 70, and 84 days, respectively. The last two species fed 39 times and 25 times during these intervals, obtaining blood in a normal manner. During the experiments, 25 infected fleas from wild rodents fed 150 times without infecting guineapigs. It would appear that X. cheopis becomes blocked earlier and more readily than other fleas and is therefore more dangerous, also that in most cases infection is only transmitted by biting over a very short period, probably not more than 1-2 days. The average length of life of the 32 infected examples of X. cheopis was only 16 days. although under the conditions of these experiments uninfected examples lived many months. Starvation due to blockage was not the only cause of their deaths, as many of them died within 4 days of having ingested blood in a normal manner, whereas uninfected examples of the same species would refuse food for 12-20 days between normal feedings on human blood. The other species of fleas all died within a short time after blockage, but when this did not occur, and prior to its development, some survived for long periods without any apparent ill-effects from the plague organisms in their gastro-intestinal tracts. Plague-infected fleas from *Peromyscus* and desert antelope ground squirrels survived as long as 35 and 58 days, respectively, which is about as long as they could be expected to live under laboratory conditions. Thus plague-infected fleas, with the exception of X. cheopis, may at times live for months and possibly for long enough to carry the infection over the period when rodents are hibernating. All the fleas that transmitted plague were females. The fact that 7 males of X. cheopis and 9 of the other species were plague-infected indicates that they do not readily act as vectors when feeding. None of the males of X. cheopis showed evidence of blockage, and as they survived an average of only 14 days, the infection undoubtedly shortened their life.

It is doubtful whether man, who acts only as a temporary host for rodent fleas, is frequently infected by rubbing infected flea faeces into the skin at the site of flea bites, for fleas seldom deposit faeces when feeding and the bites of rodent fleas seldom cause irritation. Experiments showed that virulent bacilli may be constantly present for long periods in the faeces of plague-infected fleas, and indicated that they may be more constantly present in the faeces of some species than of others. It is thought that once the bacillus becomes established in the gastro-intestinal tract, it continues to exist there until the death of the flea. *C. montanus* and *C. fasciatus* deposit faeces more frequently and in greater amounts than other fleas. It would seem that the infectiousness of flea faeces might depend on the regularity with which virulent organisms are excreted and the frequency and amount of the faecal deposits.

Observations do not entirely support statements in the literature that the virulence of the plague organism is reduced by its sojourn in the gastro-intestinal tract of fleas; several guineapigs infected by the bites of fleas died in less than 4 days, and autopsy findings indicated a much greater degree of virulence than is usually evident when infection is induced by other means. With reference to recent speculation on the possibility of plague contracted from wild rodents being more likely to cause the pneumonic type than that contracted from domestic rats, it has been found that the lungs are more constantly involved when fleas are inoculated than when tissue or cultures are used, but lesions in the lungs follow injections of plague bacilli from fleas of domestic rats as frequently as those from fleas of wild rodents.

The information obtained in these investigations suggests reasons why plague outbreaks in different parts of the world have varied considerably. In warm localities, where X. cheopis is the only rat flea, epidemics have frequently shown a tendency to subside rather quickly, which is in accordance with the observation that infected examples of this flea do not live long and cannot therefore carry infection over great intervals. As it readily transmits plague by biting, the incidence of human infection will usually be rather high where it is abundant. In colder places, where it is relatively scarce but C. fasciatus is abundant, plague outbreaks may be prolonged, with few human cases. C. fasciatus is only slightly susceptible to infection, but when infected may carry the infection for two or more months before transmitting it, and so is apparently capable of prolonging rat epizootics where they are associated with X. cheopis. unusually low incidence of human cases contracted from wild rodents during the widespread dissemination of the sylvatic epizootics over the western part of the United States can hardly be explained unless the fleas involved are rather inefficient vectors.

CHAGAS (E.) & others. Leishmaniose Visceral Americana. (Nova entidade morbida do homen na America do Sul.) Relatorio dos trabalhos realisados pela commissão encarregada do estudo da Leishmaniose Visceral Americana em 1936. [American Visceral Leishmaniasis. (A new Disease of Man in South America.) Report on the Work of the Commission charged with the Study of American Visceral Leishmaniasis in 1936.]—Mem. Inst. Osw. Cruz 32 pt. 3 pp. 321-390, 45 pls. Rio de Janeiro, 1937.

A detailed account is given of the results of investigations in 1936 on visceral leishmaniasis in Brazil [cf. R.A.E., B 25 15], of which the causal organism was described as Leishmania chagasi, sp. n., in 1937 [O Hospital 11 no. 2]. The forms of L. chagasi obtained from man and in cultures are described. It was found mainly in the spleen and liver, and did not occur in the skin. The disease, which was sporadic, was not found in towns on the coast, and the few cases in towns in the interior appeared to have been contracted outside them. Cases were generally isolated, not more than one in a household, and occurred near forests or in rural areas in districts with high rainfall. About half the infections discovered were in children under 10 years old.

Sandflies (*Phlebotomus*) occurred in all localities where infections were investigated and were the only blood-sucking insects found in some of them, so that they are regarded as the vectors. The sporadic occurrence of the cases indicated that transmission from man to man did not occur, but the animal reservoir of the parasite was not determined. Investigations of 50 dogs from infected houses gave negative results, as also did inoculations of cultures of *L. chagasi* into

monkeys, dogs, hamsters (*Cricetus cricetus*) and *Mus minusculus*. Details are given of the climate, flora and fauna of the foci investigated, which included one in the Argentine Chaco, and a list of the species of *Phlebotomus*, mosquitos and Triatomids taken in them.

Jörg (M. E.). Investigaciones sobre la enfermedad de Chagas. II.

Triatoma mazzae nova species, de Triatomidae (HemipteraHeterop. Reduvioidea), de Argentina.—Publ. Misión Estud. Pat.

reg. argent. no. 33 pp. 33-47, 15 figs. Buenos Aires, 1937.

Triatoma mazzae, sp. n., is described from a male taken in a resthouse in northern Argentina. It was not infected with Trypanosoma (Schizotrypanum) cruzi, though it was associated with T. infestans, Klug, 25 per cent. of the examples of which were infected.

Blanc (G.) & Baltazard (M.). Non-transmission à l'homme du typhus murin par piqures de puces infectées (Xenopsylla cheopis et Pulex irritans).—Bull. Acad. Méd. 117 pp. 434-446, 4 figs., 13 charts, 24 refs. Paris, 1937.

After briefly reviewing the literature on the possible means of transmission of murine typhus, the authors give an account of experiments in which attempts were made to transmit the disease to man by means of fleas (Xenopsylla cheopis, Roths., and Pulex irritans, L.) that had been kept in contact with infected rats. The fleas were allowed to bite the arms of volunteers, but none reacted, even though in one of the two experiments with X. cheopis the bites had been scratched with a view to bringing about contamination by the excreta of the fleas. However, guineapigs and a man were infected by inoculation of suspensions, and rats by the bites of fleas from the same batches. Thus man is not apparently infected by the bites of either species, and the infection cannot even be assured by the contamination of the bites by infected excreta, so that it would seem that the part played by fleas in the infection of man is negligible. In the laboratory, infection usually occurs among workers who handle infected substances, such as macerations of the organs of infected animals, and not among those who take the temperatures of infected animals and are therefore more frequently exposed to the bites of their ectoparasites.

KAURA (R. L.) & GANAPATHY IYER (S.). The Occurrence of Air-sac Mite, Cytoleichus nudus (Vizioli, 1870), in Fowls in India.—Indian J. vet. Sci. 7 pt. 4 pp. 299–301, 1 pl., 4 refs. Calcutta, December 1937.

Cytoleichus nudus, Vizioli, is recorded for the first time from India, dead and dying fowls at the breeding station at Latoli being heavily infested. The mites were active and very numerous on the walls of the entire peritoneal and thoracic cavities and on the viscera, as well as in the lungs and liver.

The Fowl Tick (Argas persicus).—Rhod. agric. J. 35 no. 1 pp. 20-25. Salisbury, S. Rhodesia, January 1938.

Argas persicus, Oken, is undoubtedly the most important pest of fowls in Southern Rhodesia. It is sometimes found also on ducks, geese, turkeys and pigeons. The females lay batches of eggs, varying

in number from 20-100, at intervals of about a month in warm weather, in cracks or crevices in fowl houses or under the bark of trees. The larvae, which hatch in about 3 weeks, immediately seek a host on which to feed or are carried after dark on the backs of the adults. They remain constantly on the bird for 5-10 days according to the temperature. If they are infected, they may transmit spirochaetosis [Spirochaeta anserina]. When they are engorged, they drop off the host, hide in crevices and transform into nymphs. The first nymphal instar lasts about 3 weeks and the second about 5. Both nymphs and adults feed only at night and shelter in cracks during the day. The life-cycle from egg to egg lasts about 10 months. The tick can exist for long periods without food, the larvae surviving for 7-8 weeks, the nymphs for a year, and the adults for 2-3 years. The adults pass by means of fences or trees from one poultry house to the next, and this is one of the most usual methods of dissemination in the suburbs of towns. Ticks may also be distributed with coops, sacking, crates or fowls.

With regard to control, if infested poultry houses are of grass, straw, or similar material, they should be burnt; if they are of iron (in which ticks hide under the overlapping sheets), straw should be burnt inside to make them as hot as possible; if they are of brick or wood they should be treated with a painter's blow-lamp, the flame being directed into all cracks and crevices, and then sprayed with a disinfectant or with kerosene emulsion. The night after treatment several birds should be put in the house to attract ticks; the operations should be repeated as long as any ticks are present. Coops, crates, nest-boxes, perches, etc., should also be treated with disinfectant or with a blow-lamp. Infested trees should be cut down and infested fences removed. The ground on which the houses stand should be saturated with kerosene emulsion. The stock emulsion is made by boiling 1/2 lb. hard soap in 1 gal. soft water until it is dissolved and subsequently adding 2 gals. kerosene; this is diluted for use with boiling water (1:4), mixed well, and applied as hot as possible. Other disinfectants that may be used, but are more expensive, are a 10 per cent. solution of carbolic acid, potassium hydroxide or sodium hydroxide, or a 20 per cent. solution of Lysol. To prevent infestation, wooden houses should be constructed of timber previously treated with solignum or a similar preparation. All houses should be sprayed once a fortnight in warm weather, and once a month in cooler weather with kerosene emulsion. All perches, nest-boxes, etc., should be moveable. All new birds should be dipped in a warm solution of a disinfectant such as Lysol. Methods of constructing perches to which the ticks cannot gain access are described.

Oswald (B.). O vrstama, pojavi i rasprostranjenosti krpelj au Jugoslaviji, s osobitim obzirom na Južnu Srbiju. [On the Species, Occurrence and Distribution of Ticks in Jugoslavia, with special Reference to southern Serbia]—Jugosl. vet. Glasn. 1938 no. 2 repr. 8 pp., 2 refs. Belgrade, 1938. (With a Summary in English.)

Surveys carried out in 1936 and 1937 in Jugoslavia, chiefly in the Vardar Province in southern Serbia, revealed the presence of 12 species of ticks. These are recorded in a table showing the stages collected, the dates and localities of collection, the hosts, and whether

or not the latter were suffering from piroplasmosis or tick paralysis. The species additional to the 9 already recorded [R.A.E., B **24** 246; **26** 7] were *Haemaphysalis leachi*, Aud., on a fox, a dog and a hedgehog, *Ixodes hexagonus*, Leach, on a fox, a sheep and cattle, and another species of *Ixodes*, either *I. frontalis*, Panz., or *I. brunneus*, Koch, on birds. Brief notes are given on the seasonal prevalence of some of the ticks.

Delpy (L.). Les espèces iraniennes du genre Haemaphysalis Koch 1844. Identité d'Haemaphysalis cholodkovskyi Olenev 1928 et d'H. cinnabarina var. cretica Senevet et Caminopetros 1936.—Ann. Parasit. hum. comp. 16 no. 1 pp. 1–10, 4 figs., 9 refs. Paris, 1st January 1938.

Ticks of the genus Haemaphysalis, which are fairly common in Persia, comprise H. cinnabarina punctata, C. & F., on cattle and sheep, H. cholodkovskii, Olen., on cattle, sheep, goats and gazelles, H. concinna, Koch, on cattle, sheep and horses, and H. inermis, Bir., on sheep. H. cholodkovskii appears to be the most abundant species, at least in certain fairly high regions, some of the specimens being taken on gazelles that live at altitudes between 8,000 and 10,000 ft. The other species were obtained chiefly from the low regions of the Caspian littoral, though examples of H. concinna were also collected in the mountains of Gilan. No ticks of this genus were found among batches from the south and south-east. As individual variations do not occur in the genus *Haemaphysalis*, no re-descriptions of the species are given. H. cinnabarina punctata was easily reared on three hosts (rabbitrabbit-sheep) and the average length of the various stages is shown in The egg stage alone is accelerated by temperatures above a table. 30°C. [86°F.], the other stages being retarded; development is also checked by temperatures below 10°C. [50°F.]. These results partly explain why this tick is found in the humid, temperate regions near the Caspian Sea and not at high altitudes. The authors consider that the tick described from Crete as H. cinnabarina var. cretica Senevet & Caminopetros [R.A.E., B 24 160] is identical with H. cholodkovskii; the characters distinguishing this species from H. cinnabarina punctata are shown in a table. Its known area of distribution lies between 20 and 60°W. Long. and 30 and 45°N. Lat. Characters distinguishing the females of H. concinna are described, and the capitula of the male and female are illustrated. Keys to both sexes of the Persian species of the genus are given.

[SIMIĆ (Č.)] SIMITCH (T.), [KOSTIĆ) KOSTICH (D.) & MLINAC (E.). Sur une nouvelle filaire du chien dans la Serbie du sud.—Ann. Parasit. hum. comp. 16 no. 1 pp. 22-27, 4 figs. Paris, 1st January 1938.

In 1928, larvae of a species of filaria were found in the proboscis of examples of *Anopheles maculipennis*, Mg., at Skoplje, and as microfilariae were subsequently observed in the peripheral blood of a dog in this town, it was concluded that the parasite was *Filaria* (*Dirofilaria*) *immitis* [cf. R.A.E., B 18 112]. Examination of 165 dogs, however, showed that 74 (of which 60 had microfilariae in the peripheral blood) were infected with a filaria that differed in its morphology and in the situation of the adults (which were in the muscular coat of the

oesophagus) from any species previously described from dogs. It is here described in detail but not named. As 3 per cent. of the examples of *A. maculi pennis* taken at Skoplje were infected with the larvae, this mosquito is believed to be the principal vector.

DE MEILLON (B.). A Note on two Beetles of Medical Interest in Natal.— S. Afr. med. J. 1937 p. 479, 2 figs., 4 refs. Cape Town, 10th July 1937.

Beetles passed alive by a native were identified as a species of *Onthophagus*; although cases of intestinal infestation of man and animals by beetles of this genus have been recorded from other countries [cf. R.A.E., B 16 251; 19 159, etc.], this is believed to be the first reported from South Africa. Attention is also drawn to skin lesions caused by Paussid beetles, which live in association with ants, but sometimes enter rooms when attracted by lights. They secrete a highly acid liquid that raises a painful blister.

Kemper (H.). **Die Bekämpfung von Schaben und Heimchen.** [The Control of Cockroaches and House Crickets.]—Z. hyg. Zool. SchädlBekämpf. **29** pt. 12 pp. 353–363, 9 figs. Berlin, 1937.

Notes are given on the bionomics of the cockroaches, Blattella (Phyllodromia) germanica, L., Blatta orientalis, L., and Periplaneta americana, L., and of the house cricket, Gryllulus (Gryllus) domesticus, L. P. americana is much rarer in Germany than the other two cockroaches, and it is only in some cities and ports that mass infestations have taken place. Its total development is estimated to require 3-4 years. Constant and careful trapping keeps down the numbers of cockroaches, but usually fails to exterminate them. Control can sometimes be obtained with pyrethrum powder, strong contact sprays applied in a fine mist, or poison-baits of borax or sodium fluosilicate mixed with flour or powdered sugar, but for rapid and complete extermination it is necessary to fumigate with sulphur dioxide, ethylene oxide or hydrocyanic acid gas. Crickets are in general amenable to the same measures as cockroaches.

Buxton (P. A.). Domestic Insects and Atmospheric Humidity.— J. Instn. Heat. Vent. Engrs 5 no. 50 pp. 80-81. London, 1937.

It is pointed out that certain insects have the power of reducing loss of water from their bodies. Thus Cimex lectularius, L., is more or less indifferent to the humidity of the atmosphere provided that it is able to obtain a blood meal from time to time, for even if the air is very dry and the loss of water from the insect considerable, the loss will be made good the next time it feeds. Adult fleas can survive over a wide range of humidities, but their larvae cannot control the loss of water vapour from their bodies and can survive only when the atmospheric humidity is high. Thus in certain parts of the world, fleas of several species have seasons of abundance and scarcity, the hot, dry weather killing the larvae and so reducing the numbers of adults of the next generation. The author suggests that the season during which fleas are rare and plague unlikely to occur might be prolonged by increasing the effect of solar radiation in warehouses and granaries by disposing them from east to west, blackening walls, etc., and at the same time reducing the humidity inside by opening shutters whenever the goods in the warehouses are damp, or the absolute humidity inside greater than that outside. This reduction of humidity in warehouses, by making use of solar radiation in a suitable climate or by artificial conditioning, is also likely to reduce infestation of stored products by moths and beetles.

Syddig (M. M.). Siphunculina funicola (Eye-fly).—Indian med. Gaz. 73 no. 1 pp. 17–19, 3 pls., 1 fig. Calcutta, January 1938.

In this preliminary article, the egg, larva and pupa of Siphunculina funicola, De Meij., are described and notes are given on its bionomics. The flies do not live more than 4-5 days in captivity [but cf. R.A.E., B 17 22]. It is likely that the length of the developmental stages varies with the temperature; the averages for the egg, larval and pupal periods under warm weather conditions in Hyderabad (Deccan) were 3, 4–5 and 2 days, respectively. Females are capable of laying 40–50 eggs; each ovarian tubule contains 2-3 follicles, and there are about 8-9 tubules on each side. Breeding takes place in moist mud, particularly that contaminated by decomposing organic matter, such as is found around improperly kept pail latrines, in badly kept stables and in badly kept and contaminated surface drains [cf. 16 252]. When water is poured on mud containing eggs they float on the surface for a few hours. The larva feeds voraciously on organic matter. A flex on which the flies rested in numbers was painted with a 2 per cent. fluorescein solution; next morning fluorescein was readily detected in several drains about 100 yards distant. Females laid eggs in large numbers in test tubes, but these failed to hatch in 2 months at laboratory temperatures or even when incubated at body heat. Staphylococcus aureus, non-haemolytic streptococci, enterococci, diphtheroids and a mould, Mucor mucedo, were isolated from a serum-agar slope on which the flies had been allowed to crawl, but no flagellates have yet been obtained from the malpighian tubes. Flies have been observed by the author to suck serum from wounds on horses and from wounds and ulcers on human beings. They are very abundant in the jungles in Hyderabad, and as the sylvan population suffers much from yaws, they may play some part in the dissemination of the disease. Since all gutters, drains, etc., in Hyderabad have been regularly oiled as an anti-malaria measure, Siphunculina has almost entirely disappeared.

DE MEILLON (B.) & GRAY (F. C.). The Control of a Species of Chironomus Meigen (Dipt. Chironomidae) in an Artificial Lake by increasing the Salinity.—S. Afr. med. J. 1937 pp. 658–660, 1 chart. Cape Town, 25th September 1937.

Two outbreaks of an unidentified species of *Chironomus* occurred in a district of Port Elizabeth in the environs of North End Lake, the first beginning about August 1934 and lasting until January 1935, and the second occurring during the same period in 1935–36. The lake had originally been a salt-pan, and there was no previous history of midges being a nuisance. About January 1934, another lake, which consisted of storm water that had probably deposited much organic matter from a native settlement, was emptied into it and storm-water drains were also led into it in order to provide a water reservoir for a power station. In addition, a pumping plant was installed so that sea-water could be supplied; as it was thought desirable to have the salinity as low as

possible, a minimum of sea-water was admitted and the salt content was consequently lower than that of sea-water. It was found that the outbreaks of midges occurred some months after the salinity of the water had been lowered by the water from the second lake in 1934 and by the heavy rains in May 1935, and disappeared in January in each year when the salinity rose. To prevent the recurrence of the nuisance, all storm water was diverted from the lake and the level maintained by pumping in sea-water only; this, aided by drought, increased the salinity to 5 per cent. in January and the midges disappeared. Even after heavy rains in July and November 1936 the chloride content of the lake did not fall below 3 per cent., the concentration indicated by laboratory experiments as being the minimum that would prevent breeding. No further outbreaks had occurred up to July 1937.

Edwards (W. H.). Report on an agricultural Survey in the Cayman Islands, with Notes on the Control of the more important Pests and Diseases which were found attacking economic Plants in that Dependency of Jamaica.—Bull. Dep. Sci. Agric. Jamaica (N. S.) no. 13, 41 pp., 6 pls., 2 figs. Jamaica, 1937.

In the course of this report [cf. R.A.E., A 26 268], notes are given (p. 28) on the mosquitos taken on Grand Cayman. Aëdes taeniorhynchus, Wied., which was the most abundant species, breeds in the brackish water that collects after rain in holes on the extensive areas of honeycombed limestone. Larvae of Culex fatigans, Wied. (quinquefasciatus, Say) were found in large numbers in the polluted water that forms pools round houses owing to the absence of drainage, and those of A. aegypti, L., occurred in water in tins under bushes round many houses.

Tulloch (G. S.). The Brackish Water Mosquitoes of Puerto Rico.—

J. Agric, Univ. P. R. 21 no. 4 pp. 581-583, 1 ref. Río Piedras,
P. R., November 1937.

Studies were carried out in Porto Rico in 1935–36 on the relation of various species of mosquitos to the salt content of their breeding places. The formation of collections of brackish water from salts in the soil or from sea-water is discussed. Lists show the 12 species taken in such waters and the ranges of salinity in which some of them were found. They include 3 species of *Anopheles*, of which *A. crucians*, Wied., is confined to brackish water, and *A. albimanus*, Wied., and *A. grabhami*, Theo., which have salinity ranges of 0–950 parts chlorine per 100,000.

O'CONNOR (F. W.) & BEATTY (H. A.). Wuchereria bancrofti in Mosquitoes of St. Croix.—Trans. R. Soc. trop. Med. Hyg. 31 no. 4 pp. 413-430, 5 figs., 11 refs. London, 25th January 1938.

The investigations here described were undertaken in the hope that further information on the behaviour of Filaria (Wuchereria) bancrofti in some of its insect hosts might indicate methods for the control of filariasis in St. Croix. The island and the history and incidence of the disease are described. From a study of the microfilariae in the blood of domestic and wild animals and birds, it appears reasonably certain that the microfilariae and larvae in the wild mosquitos studied were those of F. bancrofti. Dissection of adults of Culex fatigans, Wied.,

that had fed on patients infected with this parasite and were dissected daily until larvae were found fully developed in the proboscis showed that the minimum periods for this development were 13 days in November 1935, 17 between December 1935 and January 1936, and 9 in July 1936; the maximum periods were 1–3 days longer. The largest number of fully developed larvae found in an apparently healthy mosquito was 32 (2 in the proboscis, 10 in the head, 14 in the thorax and 6 in the abdomen). Dissection of 5,000 females of *C. fatigans* caught in the months from October 1935 to December 1936, with the exception of August–September, revealed infected examples in all months and an average infection rate of 25·08 per cent.; infective examples were found in all months except March–May and October 1936, the average infective

rate being 2.3 per cent.

Between 5th October 1935 and 15th January 1936, 386 females of Aëdes aegypti, L., were dissected and 49 per cent. were found to be infected with microfilariae or young larvae. In only 10 individuals were more than 20 parasites found; the largest numbers were 54 in the thorax of one and 66 in the thorax of another, both of which were taken in the house of an infected person. Under natural conditions, microfilariae ex-sheath rapidly in Aëdes and soon invade the thorax; most of the parasites migrate from the stomach within a few hours, and those left in it, dead or dying, were few compared with the numbers usually observed in C. fatigans. None was observed in or near the malpighian tubes or elsewhere in the abdomen. In the thorax, many parasites die even before shortening; the survivors may shorten early or may remain active and unshortened for several days. experimentally fed mosquitos, parasites, shortened and sluggish or active and unshortened, have been found alive in the thorax as long as 9 days after infection, but in no case did the development of the intestinal canal take place; after this time only dead parasites were found in the thorax up to the 13th day. Dead and degenerating parasites were found in 68 of the wild mosquitos; in degenerating parasites granulation occurs and is followed by fragmentation. Whether living or dead, the parasites did not apparently affect the host, and among experimentally fed mosquitos the mortality was much lower than in C. fatigans. The high incidence of infection in A. aegypti seems to be related to its biting habits; it is easily disturbed and has been observed to bite several persons in the same room within a few minutes [cf. R.A.E., B 25 238]. The slightness of the infections is due in part to the fact that it ingests only a small amount of blood and in part to its feeding more commonly during those hours of the day when fewer parasites are found in the peripheral blood of the human host. The larvae never reached the infecting stage.

Females of Anopheles albimanus, Wied., fed on an infected person on 9th October 1935 showed fully developed larvae in the proboscis 18 days later; young very active larvae of F. bancrofti were found in 1 out of 10 wild examples of this Anopheline. It has, however, been found only in limited areas and has been effectively controlled because it is a vector of malaria; for this reason it cannot be considered of major importance in the transmission of filariasis. The parasite has also been found in the laboratory to develop in Culex habilatator, D. & K., the duration of development being similar to that in C. fatigans, and parasites 1–7 days old were found in 4 out of 5 wild examples of this mosquito, but it has never been observed in very large numbers, and

so is not considered to be of any great importance.

During and soon after feeding, sheathed microfilariae are passed per rectum, by C. fatigans and sheathed and subsequently ex-sheathed larvae were found in the droppings until 24 hours later. Of 2,880 parasites found in 100 wild examples of this mosquito during the first 20 hours after an infective feed, 1,043 were dead or so feeble that they could undergo no further development. Parasites reach the thorax 2-24 hours after feeding [cf. 24 223]. During the first few days after a blood meal there was sometimes a heavy mortality among the mosquitos. The survivors showed a fair number of parasites, all dead, in the thorax, so that even in a known suitable vector, parasites that have reached the thorax do not invariably survive. Few parasites seem to die in the mosquito after the first two days. No parasites were found developing except in the thorax until about two days before maturity was reached; then, however, even before the tail papillae were recognisable, a few parasites were found in the abdomen, while others from the thorax exhibited definitely progressive movements.

From a study of the distribution of the mosquitos with heavy infections (more than 50 larvae), it was found that they most frequently occurred in houses where one or more persons had fairly high numbers of microfilariae in their blood at night, so that these were of great importance as foci from which the infection could be disseminated. The author discusses possible means of controlling the mosquitos and concludes that under the present conditions the only practicable method would be to discover, by studying the microfilarial incidence in man in conjunction with the incidence of infective mosquitos, the houses or groups of houses that are acting as foci of infection, and then explain to the inhabitants the nature of the disease, its mode of transmission and prevention, demonstrate to them the use of mosquito nets, encourage them to keep fowls near the house and, if possible, persuade them to kill adult mosquitos in the house daily. All receptacles for the storage of water should be adequately screened, and the maintenance and use of all screening should be supervised. The number of mosquitos in the houses and the percentage infective should be recorded at intervals to enable the results of preventive measures to be evaluated.

Yoeli (M.) & Mer (G. G.). The Relation of Blood Feeds to the Maturation of Ova in Anopheles elutus.—Trans. R. Soc. trop. Med. Hyg. 31 no. 4 pp. 437-444, 3 refs. London, 25th January 1938.

The experiments described deal with the importance of different elements of blood for the maturation of eggs of *Anopheles sacharovi*, Favr (elutus, Edw.) [cf. R.A.E., B **25** 36].

ROZEBOOM (L. E.). The Eggs of the Nyssorhynchus Group of Anopheles (Culicidae) in Panamá.—Amer. J. Hyg. 27 no. 1 pp. 95–107, 9 figs., 11 refs. Baltimore, Md, January 1938.

Descriptions are given of the eggs of Anopheles albitarsis, Arrib., A. argyritarsis, R.-D., A. strodei, Root, A. bachmanni, Petrocchi, A. oswaldoi, Peryassú, A. albimanus, Wied., and A. tarsimaculatus, Goeldi, which comprise all the species of the Nyssorhynchus group known in Panama, except A. anomalophyllus, Komp [R.A.E., B 25 74]. In most cases, specific identification can be made by egg structure,

and in those cases where the eggs of two species are similar, identification can be made when the situation in which the eggs or adults were collected is taken into consideration. Differences in the eggs lend support to the belief that A. oswaldoi and A. tarsimaculatus are distinct species [cf. 26 18]. The presence of three types among the eggs of A. strodei indicates that egg structure alone is not a dependable criterion of the existence of distinct races among species in the Nyssorhynchus group.

[VLASENKO (N. M.) Bracehho (H. M.). Zur Malariologie des Raions Bratsk von Ost-Sibirien. [The Malariology of the Bratsk Region of East Siberia.] [In Russian.]—Bull. Inst. sci. Biol. Géogr. Irkoutsk 7 no. 1-2 pp. 141-186, 57 refs. Irkutsk, 1936. (With a Summary in German.) [Recd. 1938.]

Investigations on Anophelines and malaria were carried out in the region of Bratsk, eastern Siberia, in the summer of 1933. The only Anopheline found was Anopheles maculipennis, Mg., race messeae, Flni. [cf. R.A.E., B 24 265], which occurred in settlements not more than $1-1\frac{1}{2}$ miles from suitable breeding places. It was not found in extensive areas of forest or marshland. The adults preferred animal quarters to human habitations, in which the temperature was too high and the humidity too low for them [cf. 24 69], but freely entered the latter on wet days. Outside the villages, man and domestic animals were attacked very rarely, and only in or near daytime shelters. Men who spent a night in the cattle-sheds or other unheated farm buildings were severely attacked. The apparent zoophily of A. m. messeae in this region thus depends on microclimatic conditions. There was no difference in the maxillary indices of engorged females that contained human and animal blood; in both they averaged 17.5.

Tables show the average monthly and daily temperatures for the summer in Bratsk, and it is calculated from them that the mosquito has two generations and a partial third in a year. Further study of temperatures showed that *Plasmodium vivax* could complete its developmental cycle only in the overwintered and first-generation

females

Descriptions are given of typical breeding places in the River Angara. They occur close to the banks and round small islands in places where the current is checked by aquatic vegetation.

Toumanoff (C.). Essais préliminaires d'intercroisement de St. albopicta Skuse avec St. argentea Poiret s. fasciata Théob.—Bull. Soc. méd.-chir. Indochine 15 no. 8 pp. 964–970, 5 refs. Hanoi, October 1937.

An account is given of experiments in Tonkin in one of which four generations of hybrid adults were reared from 5 females of Aëdes (Stegomyia) albopictus, Skuse, and 5 males of A. (S.) aegypti, L. (argenteus, Poir.). The progeny consisted of more than 50 individuals in each generation and all resembled A. albopictus. In another, two generations of hybrid adults were reared. Three experiments in which attempts were made to cross males of A. albopictus with females of A. aegypti were unsuccessful, except in one case in which the hybrid adults of the first generation resembled A. aegypti.

Toumanoff (C.). Contribution à l'étude de la fréquence saisonnière des diverses espèces anophéliennes sur les hauts-plateaux d'Annam et dans la basse et moyenne régions de la Cochinchine et du Cambodge.

—Bull. Soc. méd.-chir. Indochine 15 no. 8 pp. 970-980, 3 charts, 4 refs. Hanoi, October 1937.

A study has already been made of the seasonal prevalence of the Anophelines in Tonkin [R.A.E.], B **22** 32, etc.] and of certain species in the low and middle regions of Cochin China and Cambodia [cf. **25** 138]. In this paper, the author gives details of the seasonal prevalence of the Anophelines in the high plateaux region of Annam and of the species in the low and middle regions of Cochin China and Cambodia

not previously dealt with.

The following is taken from his general conclusions: The seasonal prevalence of the species in these regions appears to be very similar. That of the principal species of the high plateaux region of Annam, particularly Anopheles minimus, Theo., A. jeyporiensis, James, A. aconitus, Dön., and A. vagus, Dön., is fundamentally similar to that in Tonkin, in spite of the great difference in climate, particularly temperature. It appears from this study, as from previous ones, that the composition of the Anopheline fauna at a given season is influenced chiefly by rainfall. A. minimus, A. aconitus, and A. karwari, James, which breed in running water, are more abundant in the dry than the rainy season. In the south, however, even these species are not so obviously favoured by the dry season as they are in the north; in the south, A. minimus, and particularly A. maculatus, Theo., are frequently found in such places as marshes, which are less affected by the action of rain. On the other hand, A. vagus and A. kochi, Dön., which breed in stagnant waters, are particularly numerous in the rainy season, their increase coinciding with the extension of the available water surfaces. Such species as A. philippinensis, Ludl., A. annularis, Wulp (fuliginosus, Giles), A. splendidus, Koidz. (maculipalpis, auct.), and, to a certain extent, A. barbirostris, Wulp, and A. tessellatus, Theo., which are adapted to permanent collections of water that are not much influenced by seasons (such as ponds and lakes covered with grasses and aquatic vegetation, marshes, etc.), are the ones that show no special seasonal frequency. A. hyrcanus var. sinensis, Wied., which is frequently found in the south in streams of running water, is more abundant in the dry than in the rainy season, its seasonal prevalence being similar to that of A. minimus.

Toumanoff (C.) & Hoang-tich-Try. Nouvelle contribution à la connaissance de la faune anophélienne de la haute altitude du Tonkin (Chapa).—Bull. Soc. méd.-chir. Indochine 15 no. 8 pp. 980-991, 2 pls. (1 col.), 12 refs. Hanoi, October 1937.

In addition to the Anophelines already recorded from Chapa, Tonkin [R.A.E., B 20 133, 214], Gaschen has found Anopheles kochi, Dön., and A. jeyporiensis, James. An investigation carried out by the authors in September 1937 showed that Anophelines may be present in large numbers in stables at night, but that very few remain in them during the day or migrate to houses. Thus it appears that, in addition to the climatic factors that favour the resistance of man to malaria infection, the healthiness of this locality is due to the fact that the mosquitos are not domestic and are zoophilous. The situation of stables round the edge of the town is undoubtedly fortunate.

Two forms of A. jeyporiensis were found, var. candidiensis, Koidz., the only one hitherto known to occur in Indo-China, and one resembling the typical form, which has up to the present been recorded only from India. In spite of the presence of the former, which is an important vector in other regions, and of A. maculatus, Theo., there is little malaria, and it would appear that in this region these Anophelines are zoophilous. A. lindesayi, Giles, is also believed to be zoophilous at Chapa, since it was found freshly engorged in stables and was absent in houses. Few adults of A. gigas var. baileyi, Edw., have been taken, but two out of three were found engorged in stables.

Grewal (R. S.). Notes on the Anopheline Mosquitoes of Villages on the Arakan Coast of Burma (Abstract).—Rec. Malar. Surv. India 7 no. 4 pp. 267–268. Calcutta, December 1937.

Anopheles vagus, Dön., was the most prevalent of the Anophelines found in villages on the Arakan coast of Burma. It bred in surface wells, pools, ditches and drains, and its larvae were found in large numbers during intermissions in the heavy monsoon rainfall; they are washed away when heavy rainfall occurs. Adults were numerous in dwellings. The breeding places of A. maculatus, Theo., which was less prevalent, included pools, wells and drains containing storm water. A. culicifacies, Giles, was frequently found breeding in association with A. maculatus and also in rice-fields. It is stated that this species was responsible for an epidemic of malaria in one village following a cyclone. A. minimus, Theo., bred in rice-fields and running water in drains, A. kochi, Dön., in grassy pools and depressions containing water, A. tessellatus, Theo., in temporary pools and swamps, and A. aitkeni, James, in shaded pools, wells and ditches, but these four species were scarce. No adults of A. tessellatus were collected. Domestic breeding places of various kinds, such as earthenware vessels and old tins, were found to harbour larvae of A. vagus and A. culicifacies.

VICKERS (W. J.) & STRAHAN (J. H.). A Health Survey of the State of Kedah with Special Reference to Rice Field Malaria, Nutrition and Water Supply.—Fol., v+96 pp., 16 pls., 12 charts, 4 maps. Kuala Lumpur [1937]. Price \$1.50.

The second part of this report deals with the malaria associated with rice cultivation (pp. 10-29). Kedah is the most important ricegrowing centre of the Malay Peninsula; the industry is a rural one, and nearly half the population may be said to be associated with it. Investigations were carried out at Alor Star, the capital of the state, which is situated on the north-west coastal plain among extensive rice-fields and swamps; at Sungei Patani, the second largest centre of population, which is situated in central Kedah, in a part of the town where hilly land sloping down to the rice-fields gives rise to large areas of seepage waters; in areas where rice is grown in ravines in northeast, south and central Kedah; and in a district on the island of Langkawi, where rice is grown in ravines extending to within a few feet of the sea coast. Statistics from rubber estates show that north Kedah is almost free from malaria, benign tertian [Plasmodium vivax] being the prevailing type, central Kedah is malarious, malignant tertian [P. falciparum] predominating, and south Kedah, where both types occur, is by far the most seriously affected.

The population of Alor Star appeared to be almost free from malaria. Anopheles barbirostris, Wulp, was the only Anopheline found naturally infected (infection rate about 0.98 per cent.), but A. hyrcanus, Pall. (represented by vars. sinensis, Wied., and nigerrimus, Giles) must also be considered as a possible vector, since both it and A. barbirostris show a marked increase in numbers during the rice-growing season (September-December), a period when the incidence of malaria also rises. In order that these two species may function as efficient vectors, it appears necessary to postulate a considerable population, large numbers of mosquitos, and few domestic animals. Rice cultivation undoubtedly leads to a large increase in their numbers, and it would appear that the reason why the mosquito infection rate is so low is that 95 per cent. of the population are uninfected. The section of the population most subject to fresh infection is that living close to ricefields. A. umbrosus, Theo., and A. maculatus, Theo., which breeds commonly in the rest of the state, were not found during the survey in this area. Although the disease occurs only in a mild endemic form, the danger of an epidemic cannot be ignored in view of the abundance of suspected vectors. It is therefore recommended that the measures at present undertaken in Alor Star (oiling of seepages and streams within the limits of the town and for $\frac{1}{2}$ mile beyond) be continued and that an annual blood examination be carried out in all towns and villages in the northern section of the state, together with treatment of infected persons, to maintain the present freedom from infection. The extent of the potential breeding places round the town precludes the possibility of their elimination.

The population of Sungei Patani also seems to be practically free from malaria, although the town is in a region where A. maculatus breeds profusely in the seepage water that occurs at the junction of the high and low land, particularly during March-April and October-November, and the varieties of A. hyrcanus are also common in the rice-fields during the rice season. The scarcity of A. barbirostris is explained by the lack of requisite shade conditions that are present only in certain areas and at certain periods of rice cultivation. Here again the freedom of the human population from infection appears to be the factor governing the low incidence of malaria, and surveillance of the parasite rate is even more important in this region in view of the prevalence of such a dangerous vector as A. maculatus

in the surrounding countryside.

Where rice is cultivated in narrow ravines in hilly areas where seepage is common, malaria may be hyperendemic, as in some areas of north-east Kedah. As the ravines become broader and flatter, malaria tends to decrease (as in the endemic zones in the central and southern parts of the state) and may even be absent. In the former the houses tend to be close together, the seepages are near and the infection rate is high; in the latter the houses and the seepages are further apart and the infection rate is low. An important factor in these rural areas is the fact that most of the inhabitants have lived in the same localities all their lives. A. maculatus, which is obviously the vector, is present in these ravine areas for the greater part of the year. Seepage has been successfully controlled by extending the fields to cover the seepage areas, or by constructing contour drains and treating the water collected with Paris green; carrying the water from the seepages by underground pipes into the rice-fields also appears to offer a satisfactory solution of the problem.

On Langkawi, rice cultivation is the occupation of most of the 13,000 inhabitants and conditions are similar to those in Sungei Patani and the ravine areas. Although A. maculatus is found, A. barbirostris and A. hyrcanus are far more common. The benign tertian form of malaria predominates.

The danger of a serious epidemic of malaria in Kedah cannot be discounted in view of the presence of endemic and even hyperendemic zones, and the authors consider that the only practical solution for such

a large area is the provision of travelling dispensaries.

Duren (A.). Un essai d'étude d'ensemble du paludisme au Congo Belge.—Mém. Inst. roy. colon. belge 5 no. 5, 96 pp., 4 figs., 1 pl., 5 pp. refs. Brussels, 1937.

This survey of knowledge on malaria in the Belgian Congo contains a section (pp. 51–55) on Anopheline vectors. A list is given of the 21 species of *Anopheles* that have been taken in the Belgian Congo, the most important, in order of frequency, being *A. gambiae*, Giles (costalis, Theo.), *A. funestus*, Giles, *A. moucheti*, Evans, and *A. coustani*, Lav. (mauritianus, Grp.) [cf. R.A.E., B 21 63].

VIOLLE (H.) & SAUTET (J.). Etude du pouvoir bactérieide du Culex pipiens, race autogène, vis-à-vis du colibacille.—C. R. Soc. Biol. 127 no. 1 pp. 80-82, 3 refs. Paris, 1938.

The authors describe experiments designed to determine the reason why the digestive tracts of larvae and pupae of the autogenous race of Culex pipiens, L., from septic tanks in France contain large numbers of Bacillus coli, whereas those of the adults are sterile [R.A.E., B] 26 49]. The bactericidal power of suspensions of all stages were tested. The larvae apparently contained no bactericidal principle. pupae taken in nature, the exact age of which was unknown, the results were very variable; sometimes bacterial development was checked and sometimes it was not. Further work showed that the maximum bactericidal effect was obtained with pupae 48-72 hours old, that is to say it was related to pupal histolysis. The bactericidal power appeared to be due to a diastase. When the pupae were heated for an hour at 60°C. or for 15 minutes at 120°C. before being used, there was some decrease in bacterial development at the end of $1\frac{1}{2}$ hours but no further decrease after that time. Results with adults were similar to those obtained with heated pupae. It would appear that the bactericidal principle is composed of two elements. One, which is found in both adults and pupae, is not very active but resists heat; the other, which exists only in pupae 48-72 hours old, is more active but is destroyed by heat. The persistence of one of the bactericidal principles in the young adults enables them to resist infection that is always to be expected from the contaminated surroundings in which they live.

Lepsi (I.). Ueber Culiciden und die Malaria der Gegend von Chişinău-Bessarabien. [Culicids and Malaria in the District of Chisinau, Bessarabia.]—Bull. Mus. nat. Sci. nat. Chisinau no. 6 (1935) pp. 42-58, 2 refs. Chisinau, 1935. [Recd. 1938.]

This is an account of the results of investigations in 1932-35 on malaria and, particularly, mosquitos in the town of Chisinau,

Bessarabia, the geography and climate of which are described. The Bâc, which flows past it, frequently overflows, and the resulting swampy areas afford good breeding-places for mosquitos. The climate

is relatively dry.

Investigations in the town showed that the species present were, in order of frequency, Culex pipiens, L., Aëdes dorsalis, Mg., A. caspius, Pall., and Anopheles maculipennis, Mg., the vector of malaria [cf. R.A.E., B 23 94]. Only females of C. pipiens and A. maculipennis were observed hibernating. Among 3,000 females taken in cellars between November and March, only 15 were A. maculipennis, although this species was numerous in houses in a locality lower down the valley of the Dniester. The ratios of C. pipiens to A. maculipennis in damp and dry cellars in winter were 800:1 and 60:1, respectively. Mosquitos were not found in cellars that had been fumigated with sulphur. C. pipiens frequently entered dwellings, even in winter, but appeared to do so in search of shelter and attacked man very little. Details are given of the longevity of adults of this species at various temperatures and humidities, from which it is concluded that females live about a month after emerging from hibernation in March or April.

Aëdes dorsalis attacked man during the day, but did not enter habitations. Larvae were taken in swamps and street gutters from March onwards. It appeared to overwinter in the larval stage.

Anopheles maculipennis was rare in houses in the town, but commoner in localities on the coast where there were hardly any houses. The author agrees with the view that this Anopheline is not entophilous [21 136]. Females taken in cellars in November, January and April lived 15–21, 5 and 14–21 days, respectively, without food. The shortness of life in January is attributed to the change in temperature from cellar to laboratory, although this was only 5–10°C. [9–18°F.]. Overwintered females in the laboratory took blood readily, but very

few oviposited and all died within a month.

Figures are given for the malaria indices in Bessarabia, Chisinau and several localities in the Dniester valley in 1932–34. In 1934, 69·2 per cent. of cases in the town were benign tertian [Plasmodium vivax], 24·2 per cent. malignant tertian [P. falciparum] and 6·6 per cent. quartan [P. malariae] [cf. 20 194]. From 1·6 to 3·3 per cent. of the population was infected, but in a locality about 10 miles away this percentage was 23–25. Infections were particularly numerous in the lower valley of the Dniester. The numbers of A. maculipennis found in the city were surprisingly small; if it breeds within the city and does not migrate in from without, it might be eliminated by fumigating the cellars with sulphur to destroy the overwintering females.

[Danilova (M. I.) & Mirzayan (A. A.).] Данилова (М. И.) и Мирзаян (A. A.). The Water Factor of the Araxes Tract, the SSR of Armenia. [In Russian.]—Sci. Mem. M. Gorky St. Univ. Perm 1 no. 4 pp. 65–76, 1 pl. Perm, 1936. (With a Summary in English.) [Recd. 1938.]

Investigations in 1932 in the district of Erivan (Armenia), where the incidence of malaria is high and it is transmitted by *Anopheles maculipennis*, Mg., showed that the average numbers of larvae of this Anopheline per sample of $0.2\,$ sq. m. water surface were $64.6\,$ in

artificial water-containers fed by underground streams, 54.9 in pools overgrown with Elodeids in the former bed of the Araxes, 51.6–50 in rice-fields and other irrigated areas, and 7.5 or less in parts of the former river-bed overgrown with large reeds (*Phragmites*). The periods required for development to the adult stage averaged 21 days in water at 22°C. [71.6°F.] in the laboratory, and 18 days in shaded spots at the edge of a typical overgrown pool at 22·3°C. [72·14°F.]. A regular decrease in larval populations is being obtained by dusting with a mixture of Paris green and road-dust in the proportion of 1:3 or 1:2 and at the rate of about 4.6 oz. poison per acre, from an aeroplane flying at 60 miles an hour.

[KISELEVA (E. F.).] Kuceneba (E. Ф.). Zur Mückenfauna des westlichen Teils der Taimyrhalbinsel. [The Mosquito Fauna of the western Area of the Taimyr Peninsula.] [In Russian.]—
Trav. Inst. sci. Biol. Tomsk 2 pp. 132-135, 5 refs. Tomsk, 1936.
(With a Summary in German.) [Recd. 1938.]

Mosquitos observed in 1929–30 in the western portion of the Taimyr Peninsula, on the Arctic coast of Siberia, were, in order of frequency, Aëdes alpinus, L., which attacked man and both living and dead reindeer, A. nearcticus, Dyar, A. punctor, Kby. (meigenanus, Dyar), A. communis, DeG., and Theobaldia alaskaensis, Ludl., the last two being rare. Females of these species cause such annoyance during their flight period, which in 1929 lasted from 18th July to 2nd August, when snow fell, that the inhabitants remain indoors. There is only one generation a year.

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Meded. Dienst Volksgezondh. Ned.-Ind. 26 no. 4 pp. 217–285.

Batavia, 1937.

As a result of examination of batches of Anophelines during 1936, the following figures for maxillary indices were obtained: Anopheles sundaicus, Rdnw., 12·30; A. tessellatus, Theo., 12·37; A. annularis, Wulp (fuliginosus, Giles), 12·50; A. subpictus, Grassi (salt water), 13·68; A. barbirostris, Wulp, 13·82; A. subpictus (fresh water), 14·14; A. separatus, Leic., 14·59; A. hyrcanus var. nigerrimus, Giles, 15·07; A. hyrcanus var. sinensis, Wied., 16·35; A. bancrofti, Giles, 16·76; and A. leucosphyrus, Dön., 17·57. The batches comprised only 53-210 individuals of each species [cf. R.A.E., B 26 36].

SMALT (F. H.). Periodieke drooglegging van sawah's ter bestrijding van malaria. [The periodic Draining of Rice-fields to control Malaria.]
 —Meded. Dienst Volksgezondh. Ned.-Ind. 26 no. 4 pp. 285-299, 2 pls., 7 refs. Batavia, 1937.

With the advent of wet weather in April, there is yearly an increase in the amount of malaria in the southern part of the island of Bali, where it is endemic. Malaria was very rife in 1934. Water in the rice-fields swarmed with larvae of *Anopheles aconitus*, Dön., which were subsequently replaced by those of *A. minimus* var. *flavirostris*, Ludl. An infection index of 7 per cent. was found in females of *A. aconitus*, which would explain the very large number of fresh cases. It breeds preferably in running water and its occurrence in rice-fields is known to be associated with severe malaria [*R.A.E.*, B **20** 217, etc.].

Apart from the final draining of the fields when the crop is ripening, it is usual to drain about three times in order to promote growth. With a view to destroying the larvae, periodic draining at more frequent intervals was carried out, and in 1936 the author investigated the value of this practice by laboratory and field tests. Fields covering about 75 acres were drained 7 times between 7th March and 13th May, and it was found that the numbers of larvae of Anopheles and Culex were reduced by 67-73 and 56-66 per cent., respectively. The effect of draining was tested in the laboratory with larvae of A. annularis, Wulp (fuliginosus, Giles) and A. minimus var. flavirostris placed in trays containing a layer of earth 4 inches deep under water; or in Petri dishes. They survived for 145 and 175 minutes, respectively, in the trays after these had been drained and for 40 and 60 minutes in the dishes after the water had been removed. The importance of pools in rice-fields was shown by the longer survival of the larvae in the trays, and small pools are the only factor that can impair the effectiveness of draining.

JOHNSON (H. A.). Attractivity of Light for Anopheles Mosquitoes.
—J. Tenn. Acad. Sci. 12 pt. 1 pp. 104–106, 1 fig. Nashville, Tenn., January 1937. [Recd. 1938.]

Experiments made at Reelfoot Lake, Tennessee, in 1934–35 on the use of the New Jersey light-trap for mosquitos [cf. R.A.E., B 23 151, etc.] showed that the Anophelines present were Anopheles quadrimaculatus, Say, the principal vector of malaria in the south-east, and A. punctipennis, Say, which had both been taken by hand in 1933 in the (970) Wt. P9/3656 1600 6/38 S.E.R. Ltd. Gp. 353. [B]

proportion of 100: 1, A. crucians, Wied., which was not taken by hand until two months after it was present in the trap [cf. 23 130], and, in 1935, A. walkeri, Theo., which is also a vector of malaria [21 148, 182]. A. walkeri, which was not taken in the control hand-collections, first appeared in the trap on 14th August and on 27th comprised half the catch. It was not taken after 8th September, when cold weather had prevailed for a week. During this period, the numbers taken in the trap, in the above specific order, were 341, 8, 66, and 133, respectively.

The best results were given by a 100-watt frosted Mazda lamp, but a 60-watt light in glass transmitting ultra-violet rays was almost as effective. The attractiveness of the light increased as colours were tested through the visible spectrum from red to violet. Infra-red and photographic red (ruby) light did not attract Anophelines, but ultra-

violet did so slightly.

Bequaert (J.). Notes on Hippoboscidae: II. Additional Notes on Pseudolynchia (Diptera).—Ent. News 49 no. 2 pp. 41–44, 2 refs. Philadelphia, Pa, February 1938.

From the examination of additional material, the author concludes that $Pseudolynchia\ maura$, Big., is a synonym of $P.\ canariensis$, Macq., from which it was tentatively considered distinct in a previous paper [R.A.E.], B **24 64**].

CUÉNOD (A.). Nouvelles recherches sur le trachome. Note préliminaire.—Arch. Inst. Pasteur Tunis 24 no. 1 pp. 86-91, 2 figs. Tunis, January 1935.

Cuénod (A.) & Nataf (R.). Nouvelles recherches sur le trachome.— Op. cit. 25 no. 2 pp. 295–312, 4 figs., 8 refs. April 1936.

Cuénod (A.) & Nataf (R.). Nouvelles recherches sur le trachome.

Troisième Note.—Op. cit. 26 no. 1 pp. 1–12, 1 fig., 12 refs.

March 1937.

Cuénod (A.), Nataf (R.) & Louritch (G.). Le pouvoir infectant des crottes de poux préalablement inoculés de virus trachomateux.—

Bull. Soc. Path. exot. 31 no. 1 pp. 22-23, 7 refs. Paris, 1938.

In the first paper, the author describes certain elements in the protoplasmic débris from the follicles of trachoma, which are considered, after further observations discussed in the second paper, to be allied to Rickettsia. This view was supported by work at São Paulo, Brasil, by A. Busacca, who in 1933 considered the microbial elements in trachomatous tissues to be a species of Rickettsia that in 1935 he named R. trachomae. The areas of distribution of trachoma and typhus are very similar, and, as both are diseases associated with poverty and overcrowding, it was thought that lice (Pediculus humanus, L.) might be concerned in transmission of the former. Examination of large numbers of lice from persons suffering from trachoma revealed typical rickettsiae in an average of 5 per cent. In experiments, also described in the second paper, lice inoculated with pulp from trachomatous follicles harboured large numbers of rickettsiae, and suspensions of such lice injected into the eyes of monkeys (Macacus inuus) gave rise to light attacks of experimental trachoma.

In the third paper, it is reported that further experiments in which reared lice free from all possibility of contamination were inoculated with trachomatous pulp confirmed previous results, pure cultures of rickettsiae being produced in them. Moreover, subinoculations were made from these lice to other normal reared lice, which in their turn became infected, and it was found that, although after the initial inoculation the mortality among the lice was high, from the second passage onwards it became very low. The appearance of the typical rickettsiae seen in smears of the intestinal contents of experimentally infested lice is described. The other experiments described in this paper include one in which typical trachoma was produced in man by the inoculation of a culture of rickettsiae obtained from lice previously infected with trachomatous pulp.

In the fourth paper is described an experiment in which trachoma was produced in a monkey (M. inuus) by inoculation of excreta from subinoculated lice. This suggests that the disease may be propagated by means of fingers that have become contaminated with excreta when scratching to relieve the irritation provoked by the lice. This view is supported by an experiment in which trachoma was produced in a monkey by the inoculation of dirt from beneath the nails

of an infected child infested with lice.

Blanc (G.), Goiran (E.) & Baltazard (M.). Observation de deux cas de fièvre boutonneuse à Conakry (Guinée Française) et découverte, chez les rhipicéphales de la région du chalcidien parasite Hunterellus hookeri.—Bull. Soc. Path. exot. 31 no. 1 pp. 23-28, 1 chart, 16 refs. Paris, 1938.

The authors describe two cases of Marseilles fever that occurred in French Guinea in May 1937, in which the infection was probably contracted from ticks harboured by the patients' dog, which had become infested on board ship during the voyage from Marseilles to Conakry. This would suggest that the virus is frequently introduced by boat, although systematic examination of ticks of the genus *Rhipicephalus* sent from Conakry has so far yielded negative results. The Encyrtid parasite, *Hunterellus hookeri*, How., emerged from some of the nymphs kept in a humid atmosphere at 30°C. [86°F.]; this is believed to be the first record of its occurrence in French West Africa.

BRUMPT (E.). Présentation de préparations microscopiques. Transmission expérimentale d'un trypanosome, parasite de la cavité générale d'Hyalonma pusillum, à diverses espèces de tiques.—Bull. Soc. Path. exot. 31 no. 1 pp. 42-44. Paris, 1938.

A high proportion of examples of the tick, Hyalomma pusillum, Schulze, collected at Bagdad and Kish in Iraq in October 1937 harboured a trypanosome. This trypanosome was successfully transmitted by inoculation from tick to tick. Intense infections were obtained in H. pusillum, H. dromedarii, Koch, and Rhipicephalus sanguineus, Latr., a weak infection in Hacmaphysalis campanulata, Warb., and no definite infections in Boophilus (Margaropus) calcaratus, Bir., Dermacentor reticulatus, F., Amblyomma cayennense, F., a species of Hyalomma from cattle in Crete, Argas persicus, Oken, and various species of Ornithodorus. The flagellates fill the general body cavity but are not seen in the digestive tract; they are thought to be transmitted hereditarily. They are primarily parasites of ticks and, although a receptive vertebrate host may be found, experiments on the inoculation of mice have been unsuccessful. They are injurious to the ticks, since, at least in experiments, the latter succumb more or less

rapidly when the infection is dense. The number of eggs laid by infected ticks is low, and none was deposited by examples of \hat{H} . pusillum in which the body cavity was filled with parasites.

The literature on similar parasites found in ticks is briefly reviewed; Trypanosoma christophersi was obtained from Rhipicephalus sanguineus

from dogs in Bagdad in 1930 [cf. R.A.E., B 18 124].

KAURA (R. L.). Common Contagious and Parasitic Diseases of Poultry in India and their Control.—Agric. Live-Sth India 7 pt. 6 pp. 745-755, 3 pls. Delhi, November 1937. Part II.—Op. cit. 8 pt. 1 pp. 26-39, 2 pls. January 1938.

In the second part of this paper the author gives a brief account of spirochaetosis of poultry, caused by Spirochaeta anserina (gallinarum) and transmitted by Argas persicus, Oken, together with notes on its control. He also records in tables the mites, lice and parasitic worms that infest fowls and other domestic birds, giving their scientific and popular names and notes on the ways in which they infest their hosts, the type of injury they cause, remedial and preventive measures, and, in the case of the worms, their insect hosts where these exist.

MacLeod (J.). The Sheep Tick (Ixodes ricinus) and its Control in Great Britain.—Bull. Cooper tech. Bur. no. 2, 27 pp., 8 figs. London, 1938.

In this bulletin, a somewhat popular account is given of the bionomics of *Ixodes ricinus*, L., an important parasite of sheep in Britain [cf. R.A.E., B **20** 274], together with information on its relation to louping ill [cf. 20 266] and tick-borne fever [cf. 24 249]. Methods of control are discussed. It is suggested that in cases where ordinary sheep-farming methods are not practised and the primary consideration is the removal of the ticks, the sheep should be dipped at short intervals throughout the tick season (mid-March to the end of May) in a derris wash or some other preparation that may be used repeatedly without harming them. On sheep farms where it is desirable to increase the farm profits without interfering too greatly with the normal sequence of farming activities, especially during the busy lambing-season, which coincides with the tick season, it is suggested that the sheep be dipped in one of the special preparations now available that will protect them from re-infestation for 2-3 weeks after its application; the two main dippings (one of which is carried out immediately before lambing begins and the other about three weeks later) may be augmented by one or two supplementary dippings, according to circumstances. For farms where profitable farming is impossible unless ticks are eradicated, a scheme combining starvation of the ticks with serial dipping of the sheep is recommended [cf. 21 203].

Lewis (E. A.). Sheep Scab in Kenya Colony.—E. Afr. agric. J. 3 no. 4 pp. 298-306, 7 figs., 8 refs. Nairobi, January 1938.

The subject of sheep rearing in Kenya and the effect of infestation by *Psoroptes ovis*, Hering, on the economic production of wool is briefly discussed. In experiments carried out from October to December 1930 and from May to June 1931, the egg, larval, nymphal and pubescent female stages of the mite lasted 48, 48–56, 48–60 and 48 hours, respectively, and the pre-oviposition period of ovigerous females about 48 hours. There was no significant difference between

the life-cycles during October-November and during May-June. These results do not differ from those obtained in other countries [cf. R.A.E., B 25 18, etc.], although further investigations may show that the period of development is longer under conditions less favourable to the mite. The influence of climate on its incidence is discussed from the literature, together with the probable times of maximum incidence in Kenya. The question of dipping for its control is mentioned [cf. 25 160], and a few observations made in the course of an uncompleted trial of two proprietary dips, one of arsenic and the other of lime-sulphur, are recorded.

GILL (D. A.) & GRAHAM (N. P. H.). The Effect of the Mules Operation on the Incidence of Crutch Strikes in Ewes. An interim Report on a current Trial at "Dungalear" Station.—J. Coun. sci. industr. Res. Aust. 11 no. 1 pp. 30-34, 2 refs. Melbourne, February 1938.

Details are given of a further trial that is being carried out to test the value of Mules' operation in preventing infestation by blowflies in Merino sheep in Australia [cf. R.A.E., B 25 246]. The results obtained so far are regarded as sufficiently satisfactory to warrant an interim report. The following is taken from the authors' summary: Of 650 sheep, 325 were treated. The aim of the operation was the removal of the medial breech fold and of the lateral breech fold when this was considered desirable. When only those sheep that were struck primarily on the breech were considered, the ratio of struck sheep in the treated and untreated groups was 1:12; when 24 cases in which the origin of the strike was doubtful were included, the ratio was 1:8. Of the 9 treated sheep that were struck, 6 had been ineffectively treated.

Myers (J. G.). Report on the natural Enemies in Haiti of the Horn-fly (Lyperosia irritans) and the Green Tomato Bug (Nezara viridula).—
J. Coun. sci. industr. Res. Aust. 11 no. 1 pp. 35-46, 1 map, 20 refs. Melbourne, February 1938.

An account is given of an investigation carried out in Haiti between 14th October and 22nd November 1936, which included observations on the natural enemies of *Lyperosia irritans*, L. The distribution of this fly is very restricted. It occurred on cattle at altitudes ranging from sea-level to nearly 6,000 ft., in country with vegetation varying from cactus shrub to mountain rain-forest, but was absent from other apparently similar localities, and it is thought that this may indicate its recent introduction. The effect of dung-competitors and parasites was insignificant, at least at the time of the investigation, but that of predators was thought to be of considerable importance. The most efficient of these were, firstly, the Histerid, *Hister coenosus*, Erichson, and, secondly, the larvae of a species of *Limnophora*, but it is difficult to estimate how far they are responsible for the comparatively low incidence of *Lyperosia*.

Mackerras (I. M.). The Occurrence of Stick-fast Fleas in Queensland. —J. Coun. sci. industr. Res. Aust. 11 no. 1 pp. 71–72, 1 ref. Melbourne, February 1938.

Echidnophaga gallinacea, Westw., which has not previously been recorded from the eastern States of Australia [cf. R.A.E., B 11 150; (970) [B]

25 225], has recently been taken on dogs in two localities in Queensland and in one in New South Wales. There is no doubt that it is widely established in a belt of country between the Macintyre and Warrego Rivers, but does not yet appear to be of importance. A single example of *E. myrmecobii*, Roths., was also taken on a dog in one of the localities in Queensland; it is an indigenous species, widely distributed in New South Wales, Victoria, South Australia and Western Australia, that has been found on a number of native animals as well as on rats and rabbits [cf. **11** 151].

CAMPBELL (T. G.). Recent Investigations on the Buffalo Fly (Lyperosia exigua de Meijere) and its Parasites in North Australia.—J. Coun. sci. industr. Res. Aust. 11 no. 1 pp. 77-82, 1 pl., 1 map, 2 refs. Melbourne, February 1938.

Details are given of an investigation carried out in North Australia between 26th March and 11th June 1936 to determine the abundance of *Lyperosia exigua*, de Meij., the extent of the injuries it was causing to stock and the incidence and fertility of parasites of the genus *Spalangia* in areas in which they had been liberated [cf. R.A.E., B 20 259] and in other areas for comparison.

It is concluded that the density of the fly and the damage caused by it were the same as in previous years [cf. 25 131]. The increase in parasitism amounted to less than 5 per cent. and cannot therefore be considered significant. A comparison of the results of breeding experiments carried out in 1932–33 with the results of similar experiments with parasites from the centres in which the different forms had been liberated showed that no appreciable increase in their longevity or powers of reproduction had taken place. Since all the parasites from the several localities in 1936 were identified as S. orientalis, Graham, variations in longevity and fecundity recorded in the experiments in that year may be regarded as fortuitous. It thus appears that the introduced parasite, S. sundaica, Graham, has failed to become established or has become merged by interbreeding with the indigenous form.

Strong (L. A.). Report of the Chief of the Bureau of Entomology and Plant Quarantine, 1937.—98 pp. Washington, D.C., U.S. Dep. Agric., 1937.

Part of this report (pp. 65-75) deals with work carried out in 1936-37 on insects affecting man and animals in the United States.

Further observations [cf. R.A.E., B 26 85] were made on the spread of Cochliomyia hominivorax, Coq. [americana, Cush. & Patt.] from the overwintering area, which, in Texas, was south of the Edwards Plateau escarpment and as far eastward as San Antonio. All of Texas, parts of western Louisiana, and the lower desert section of Arizona were re-infested early in July. In 1937, the rate of spread northward was about the same as in 1936 [loc. cit.], but towards the east it was more rapid. Studies showed that the mature larvae and pupae can withstand greater extremes of acidity and alkalinity than exist naturally in the soil. Nearly 50 per cent. emergence was obtained in sand one-fourth saturated with 0.2 N. sulphuric acid or with 1.0 N. potassium hydroxide. Tolerance for acid or alkaline media decreased with increasing humidity.

Experiments in progress with various larvicides are reviewed [cf. 26 86]. Thiodiphenylamine (phenothiazine) applied to a wound prevents the establishment of newly hatched larvae in the tissues of the host, but does not repel flies or prevent oviposition. Thus, injury to the animal is prevented and, at the same time, breeding is considerably reduced. Sodium cyanide (\frac{1}{4} oz. per U.S. gal. water) and carbon bisulphide (1 part of a 1:1 emulsion with neutral Turkey-red oil to 64 parts water) both killed all the larvae of this and other species of blowflies in the soil when applied at the rate of 2 U.S. gals. per sq. yd. of surface. The former also destroyed the pupae of C. hominivorax in the soil.

Winter activity of this fly is restricted to areas in which the mean temperature is above 55°F. This natural control does not become effective early enough in the autumn to aid in preventing outbreaks when animals are marked, castrated and fattened in the fields in the south-eastern States. The high degree of control obtained during the autumn of 1936 was due to the co-operation of stock-owners throughout the year. The retardation of spread by control measures is illustrated by the fact that in one locality the first cases occurred on 1st May in 1936 whereas they did not occur until 25th May in 1937. Statistics are given on the rates of infestation and mortality among domestic animals in the various states during recent years, and it is concluded that the control work during 1936–37 reduced the cases of infestation and death among livestock in Texas and other south-western states and further reduced them in the south-eastern states.

A larvicide composed of 50 cc. benzol, 5 cc. cresol, 45 cc. liquid vaseline (liquid petrolatum) and 1 gm. rotenone for treating cattle infested with cattle grubs [Hypoderma] was found to be as efficient when applied to the surface of the skin and rubbed in with the fingers as when injected into the openings of the lesions. Only 1.25-7.69 per cent. of the larvae survived such general treatment, and 3-5 times as many cattle can be treated by one operator. Derris root containing 3 per cent. rotenone diluted to 0.125 per cent. rotenone by mixing with 23 parts diatomaceous earth by weight, or powdered devil's shoestring [Tephrosia virginiana] diluted to the same percentage of rotenone, was found to be effective and economical against both biting and sucking lice on cattle and horses. A solution of 0.5 gm. rotenone in 100 cc. carbon tetrachloride sprayed lightly into the coat of infested animals also proved effective and rapid in action. The carbon tetrachloride evaporates almost instantly, leaving fine particles of rotenone in the hair. The spray is more easily and more rapidly applied than the powders, but the materials are more costly, since about 4 fl. oz. was required to treat a full-grown animal. Studies on the biology and habits of Melophagus ovinus, L., an important parasite of sheep in the north. indicate that a strain that can withstand the hot, dry weather of the south-west has developed during the last 15-20 years, and that it is rapidly becoming a serious problem on the ranges in that section of the country. Preliminary tests have shown that a dip of wettable sulphur (325-mesh) will destroy the adults but not the pupae. Derris powder containing 1-3 per cent. rotenone killed all stages but the engorged females of the American dog tick [Dermacentor variabilis, Say], and derris powder or devil's shoe string containing approximately the same amount of rotenone controlled the winter tick [D. albipictus, Pack.] on horses and cattle, 4-9 oz. being necessary for the treatment of an adult animal.

Recent experiments have shown that Paris green, when mixed with water and applied as a spray, destroys Culicine larvae that feed below the surface. It may be applied with a watering can or knapsack sprayer at rates as low as 1 lb. per acre. Two preliminary tests indicated that an autogiro, owing to its relatively low speed, could probably be adapted to apply this spray to large mosquito breeding areas that are not otherwise accessible. Samples of calcium arsenite having a comparatively high percentage of water-soluble arsenic were found to be nearly as toxic to mosquito larvae as Paris green, and it seems probable that this material could be produced commercially at a cost appreciably lower than that of Paris green. Anopheles albimanus, Wied., occurs in the United States only in the lower Rio Grande valley in Texas, and, judging by the apparent temperature limitations there, it seems unlikely that it could survive in other parts of the Gulf Coast states, except in southern Florida, where climatic conditions would appear to be favourable for its propagation.

Approximately 50 per cent. of the colonies of fire ants (Solenopsis spp.), which are very destructive to young quail in the south-eastern states, were destroyed by applying a solution of 1 oz. sodium cyanide in 1 U.S. gal. water. A higher proportion of the cyanide increased the efficiency of the solution in sandy soils, but 1 oz. dry cyanide placed 3-6 inches below the surface of the soil appears to be more effective than the liquid in clay soils, although it is less effective in sandy ones. Better results were obtained when the liquid was poured down the galleries rather than into holes made in the ground around the colonies, and when treatment was carried out in March and April rather than in May-July, and in wet weather rather than in dry. Tests with carbon bisulphide, as an undiluted liquid and as an emulsion, and chloropicrin indicated that they were satisfactory materials for destroying the

colonies.

THOMSEN (M.). Stuefluen (Musca domestica) og Stikfluen (Stomoxys calcitrans). Undersøgelser over Biologi og Bekaempelse samt en Oversigt over andre til Husdyr eller Boliger knyttede Fluearter. [The House-Fly (M. domestica) and the Stable Fly (S. calcitrans). Investigations on their Biology and Control, with a Review of other Species of Flies associated with domestic Animals or Dwellings.]—Beretn. Vet.- og Landbohøjsk. Forsøgslab. no. 176, 352[4] pp., 107 figs., 13 pls., 14 pp. refs. Copenhagen, 1938.

The greater part (pp. 16–252) of this report of work on flies carried out in Denmark in 1932–36, much of which has already been noticed [R.A.E., B 22 230; 24 43; 25 92, 244, 282], is devoted to Musca domestica, L. Shorter sections deal with work on Stomoxys calcitrans, L. (pp. 253–286), a group of flies associated with cattle in fields, comprising Lyperosia irritans, L., Haematobia stimulans, Mg., Musca autumnalis, DeG., M. tempestiva, Fall., and species of Morellia and Hydrotaea, and species found in association with cow-dung in fields (pp. 287–320), and flies associated with dwellings, stables and manure (pp. 321–334). Detailed accounts are given for the more important species, and briefer ones for the less, of their morphology, distribution, bionomics and ecology, medical, and veterinary importance, and control. The text is illustrated with numerous figures and plates, and a systematic list is appended of the Diptera dealt with.

LLOYD (L.). Observations on Sewage Flies: their Seasonal Incidence and Abundance.—Proc. Inst. Sewage Purif. 1937 pt. 1 repr. 16 pp., 8 charts, 5 refs. Kew, 1937.

Systematic investigations on the insect fauna of the bacteria beds of sewage works in Yorkshire have been carried out during recent years at Knostrop, Leeds, and at Barnsley [cf. R.A.E., B 22 179; 23 238, 239; 24 91, 92]. The studies, which deal particularly with Psychoda alternata, Say, P. severini, Tonn., Spaniotoma minima, Mg., Metriocnemus longitarsus, Goet., and M. hirticollis, Staeg., included observations on the seasonal prevalence of the adult flies (judged by continuous trapping), on the climatic conditions of the beds, and on the bionomics of the flies in the laboratory. During the summer, P. alternata may become so abundant as to cause local annoyance; this indicates a lack of balance in the fauna of the beds, and it was hoped that the reasons would be exposed and some means of adjustment be found that would not interfere with the efficient working of the system of purification.

The effect of temperature on insects in general is briefly discussed, together with the methods used in the laboratory to determine the effect of temperature on the flies and the statistical treatment of the data obtained. The seasonal incidence of all five species for 1934, 1935 and 1936 is shown in charts as monthly percentages of the year's

total catch.

Spaniotoma minima usually forms a mating swarm low over the beds or grass or in the channels. Pairing has been observed on mild calm days in mid-winter when the air temperature was 10°C. [50°F.]. From laboratory observations, the temperatures most favourable for all stages of development would appear to lie between 8 and 21°C. [46·4 and 69·8°F.]. About 200 eggs are laid in mucus, and in the beds such batches are common just below the surface stones, though it is not known whether they are confined to this zone. The larva is active and will eat the eggs of both species of Psychoda; it attacks the cocoons of Metriocnemus and sometimes devours the pupae. It does not climb to pupate [cf. 24 92], but makes its cocoon of débris in or near its food. The cocoon is easily pulled to pieces by the larvae of the other species, and the pupa, which wriggles free, must then be liable to be washed away. The fly increases in summer and reaches its maximum numbers about August-September at Knostrop and rather later at Barnsley; it is fairly prevalent in winter, but its numbers are low between February and May.

The male of *Psychoda severini* has never been observed by the author, either in rearings or in nature, so that no losses can be attributed to the failure of pairing through adverse weather conditions. The temperatures most favourable for development lie between 6 and 20°C. [42.8 and 68°F.]. About 100 eggs are laid, usually in the food. No cocoon is made; the pupae are lodged in the food or débris and must frequently be dislodged and washed out of the bed. The eggs and pupae are eaten by the larvae of *M. longitarsus* and the eggs by *S. minima*. The larvae are sluggish, but have carnivorous tendencies; they eat the eggs of *P. alternata* and the pupae of *Metriocnemus* and *S. minima*. The adult flies are practically absent from the beds at Knostrop from July to January; in 1934 and 1935 their numbers reached a peak in April and May, but in 1936, when the winter and spring were colder, the peak was in June. At Barnsley, where they occur throughout the year, they are much more abundant; they are

numerous in winter but are much less so in summer and autumn, when

P. alternata and S. minima are prevalent.

Under mild conditions, P. alternata pairs on the beds and walls. There is no swarm, but the adults cluster in dark places. As all phases of development can take place in complete darkness, this species need not leave the shelter of the bed when the weather is adverse. The female lays about 130 eggs, but if pairing has not occurred, oviposition rarely takes place and the eggs do not hatch. The zone of temperatures favourable for all stages of development is from 16°C. [60.8°F.] to 25°C. [77°F.] or rather higher. The pupae are lodged as are those of P. severini, and both pupae and eggs are subject to similar attacks, but their effect is less marked in the case of P. alternata owing to its more rapid development at median and high temperatures. It is most numerous from early summer to early autumn and, like P. severini, is more abundant at Barnsley than at Knostrop. At Barnsley in 1936 it increased later than usual (probably because the beds were colder in winter) and reached its maximum in October when it is usually becoming scarce. In most seasons, there is a reduction in numbers in the middle of summer, which is associated with the summer reduction of bed film.

The females of the two species of Metriocnemus deposit about 450 eggs in mucus ribbons. The cocoons are clear mucus, and the pupating insects tend to cluster. There is a high pupal mortality, so that the number of flies that emerge gives but a poor indication of the large numbers of larvae that often occur in the beds. The larvae are active and powerful and may play an important part in controlling the smaller flies; they eat the eggs and young larvae of both species of Psychoda and the pupae of P. severini and S. minima. M. longitarsus will pair readily in confined spaces without swarming, and fertilised females may be obtained throughout the year except, perhaps, in the height of summer. The lower limit of the zone of favourable temperatures is probably below 5°C. [41°F.] and the upper one about 18°C. [64·4°F.]. In 1934, 1935 and 1936, peaks of abundance occurred at Knostrop in January and May; in the autumn there is more variation in incidence and this is almost certainly due to the effect of wetter or drier summers on surface pupation. M. hirticollis rarely pairs in confined spaces, so that adverse weather when the flies are swarming must have a more unfavourable effect on it than on the allied species. Fertilised females are difficult to obtain in winter. The favourable temperature zone for this species has not been exactly determined, owing to variable behaviour in the larval stage dependent on factors not yet defined, but 20°C. [68°F.] is within it. Its abundance and its seasonal incidence at Knostrop have varied more from year to year than those of M. longitarsus, probably because of the greater importance of equable weather for pairing. It usually reaches its peak later than M. longitarsus, a finding that is consistent with its higher thresholds of development.

The seasonal abundance of the different species of flies at Knostrop and Barnsley are compared, and it is pointed out that, although there is little difference in the climate of the two places, there are many differences in the structure and the working of the beds. Of these, the most important would appear to be the practice at Barnsley of giving the beds long complete rests, often for as long as a fortnight; at Knostrop the beds are rarely rested during the day and then only for 2–3 consecutive days. These rests dry out the surface of the beds and make them temporarily unsuitable for the oviposition and pupation

of the species of Metriocnemus, which are very susceptible to death by desiccation in the egg and pupal stages. The species of Psychoda also find the drying conditions adverse, but are less dependent on the surface layers of the bed. Thus prolonged rests in summer are adverse to some of the competitors for the available food and at Barnsley the absence of species of Metriocnemus, the absence of slugs, and the late incidence of S. minima may be partly responsible for the greater abundance there of Psychoda. Another factor that may be considered is the cooling effect that the tank effluent has on the bed surface when the machine is working. Data show that in summer the resting bed must have an appreciably higher mean temperature and in winter a lower one than the working bed. Among the insects considered, high temperatures are favourable only to *P. alternata*, the life-cycle of which is reduced from 25 days at 18°C. to 20 days by a rise of 3°C. [5.4°F.] in the average temperature. It is suggested that where prolonged day rests are practised and annoyance from flies is serious, it might be practicable to start the machines at intervals on warm drying days, and so keep the surface from overheating. Such a procedure would not, perhaps, lead to an immediate improvement, but after two or three years it might lead to a better balance in the fauna of the beds.

Jettmar (H. M.). Untersuchungen über die in Hochquell-Anlagen vorkommenden makroskopischen Lebewesen. [Investigations on the macroscopic living Organisms occurring in Mountain Spring Waterworks.]—Z. hyg. Zool. SchädlBekämpf. 30 pt. 1 pp. 1–21, 8 figs., 10 refs. Berlin, January 1938.

The results are given of an investigation of the fauna of underground or covered mountain spring water intakes in Austria, conducted with a view to discovering which invertebrates are liable to cause pollution. Flies of the genus *Leptocera* appear to be the most important, *L. sylvatica*, Mg., being particularly common. It was found in abundance in the darkest and innermost parts, such as adits. It settles on the walls above the water, into which its excreta drop. The Tettigoniid, *Troglophilus cavicola*, Kollar, was found in several waterworks, where it apparently feeds on *Leptocera* spp. and other insects. It was often parasitised by a Nematode, *Gordius aquaticus*. Its excreta sometimes contained bacteria, including *Bacillus coli*.

Greimer (K.) & Michael (H.). Handbuch des praktischen Desinfektors. Ein Leitfaden für den Unterricht und ein Nachschlagebuch für die Praxis. [A Hand-Book for the practical Disinfector. A Text-book for Teaching and a Reference Book for practical Work.]—Demy 8vo, xii+203 pp., 44 figs. Dresden, T. Steinkopff, 1937. Price M. 6.

About one-third of this hand-book deals with Arthropods occurring in houses in Germany and includes brief sections on the biology and control of Cimex lectularius, L., the lice, Pediculus humanus, L., P. h. capitis, DeG., and Phthirus pubis, L., flies, mosquitos, and Pulex irritans, L. German legislation relating to poisonous fumigants is reviewed.

Buxton (P. A.). Studies on Populations of Head-lice (*Pediculus humanus capitis*: Anoplura). II.—Parasitology **30** no. 1 pp. 85–110, 14 refs. London, 25th February 1938.

The results are given of further studies [cf. R.A.E., B 24 97] on the prevalence of head lice, *Pediculus humanus capitis*, DeG., the data being obtained from more than 2,000 crops of hair collected in Nigeria, Kenya, Ceylon and Palestine.

The following is taken from the author's summary: Among infested persons, the commonest count is always low (generally 1-10 lice), but occasional counts of many hundreds or a few thousands are recorded. If the people are grouped by age, sex, etc., a positive correlation is generally found in each group between the proportion of individuals infested and the mean number of lice per infested person. There is clear evidence from several places that season affects the frequency of infestation; lice are usually most widely distributed during the colder, wetter part of the year, but it is not known whether this is due to an effect upon the insects themselves or upon human habits and activity. Boys were more frequently infested than youths, who in turn were more frequently infested than grown men. In some places, females are more frequently infested than males, but in one locality there was no difference between the sexes. The weight of the individual's crop of hair is in most cases positively correlated with infestation. Many of these factors are local and depend on racial customs.

Cumming (H. S.). Le typhus exanthématique aux Etats-Unis.—Bull. Off. int. Hyg. publ. 30 fasc. 2 pp. 296–297. Paris, February 1938.

The average annual number of cases of typhus in the United States was about 100 from 1921 to 1930 and well over 1,000 during the next six years. The great increase in the incidence has been accompanied by an increase in the number of cases recorded from the rural sections of the south; of 1,662 cases in 1936, 1,471 occurred in Georgia, Alabama and Texas. Facts continue to show that rodents are the reservoir, and that fleas, usually *Xenopsylla cheopis*, Roths., transmit the disease to man [cf. R.A.E., B **20** 143, etc.]. No cases of louse-borne typhus are believed to have occurred in the United States in 1936. The recovery of the virus from the brain of a wood mouse (Peromyscus polionotus), caught in a region where cases of typhus were known to have occurred, indicates a possible explanation of the dissemination of the disease from the urban to the rural areas, since this mouse is common in the southern states where cases of rural typhus are becoming more frequent. A list is given of various other species of indigenous rodents that, with the opossum (Didelphis virginiana), have been shown by laboratory experiments to be susceptible to infection and may therefore act as reservoirs of the disease in nature.

DAVID (H.) & EIDHERR (A.). **Ueber die Tularämie.**—*Z. hyg. Zool.*SchädlBekämpf. **30** pt. 2 pp. 40-51, 16 refs. Berlin, February 1938.

A review is given of the literature on tularaemia, caused by *Bacterium tularense*, and its rodent hosts, Arthropod vectors, transmission to

man and geographical distribution. Of cases observed in Austria and Czechoslovakia, none has hitherto been traced with certainty to transmission by ticks or insects.

GEISTHARDT (G.). Uber die ökologische Valenz zweier Wanzenarten mit verschiedenem Verbreitungsgebiet. [The ecological Valency of two Species of Bugs having different Areas of Distribution.]—

Z. Parasitenk. 9 no. 2 pp. 151–202, 12 figs., 2 pp. refs. Berlin, 1937.

The experimental technique is described and the results are discussed in detail of observations on the development of *Cimex lectularius*, L., and *C. hemiptera*, F. (rotundatus, Sign.) at various temperatures and humidities, in an endeavour to explain the differences in their areas of distribution, which are given, by physiological characteristics [cf. R.A.E., B 23 136]. The bugs were in most cases fed on guineapigs, but some were reared on man. Human blood was, in general, the more favourable. The results are all illustrated graphically by curves of different kinds.

Eggs of *C. lectularius* and *C. hemiptera* hatched at 14–36 and 18–37°C. [57·2–96·8 and $64\cdot4$ –98·6°F.] respectively, and the nymphs completed development to the adult stage at 15–33 and 19–33°C. [59–91·4 and $66\cdot2$ –91·4°F.]. The temperatures at which the egg and nymphal stages were shortest were 33 and 31·5°C. [88·7°F.] and 34 and 30·5°C. [93·2 and $86\cdot9$ °F.], respectively, for the two species.

Variations in atmospheric humidity had no effect on the duration of the egg stage in either species, but the development of nymphs of *C. hemiptera* was protracted by low relative humidities (6 and 44 per cent.) at all vital temperatures, whereas the lowest relative humidity was detrimental to *C. lectularius* only at extreme temperatures.

Observations on mortality showed that under optimum environmental conditions, 100 per cent. of eggs of C. lectularius hatched at 17–34°C. [62·6–93·2°F.] when humidity was optimum (70 per cent.), and of C. hemiptera at 19–36°C. [66·2–96·8°F.] and 93 per cent. humidity. At optimum temperatures of $27\cdot5$ and 29°C. [81·5 and $84\cdot2$ °F.] respectively, no mortality occurred between 5 and 100, and 40 and 100 per cent. relative humidity. The optimum humidity for nymphs of C. hemiptera appeared to be 97 per cent. The limits of temperature and humidity within which no mortality occurred were narrowed as development proceeded. At 22°C. [71·6°F.] and optimum humidity, mortality of eggs, nymphs and young adults was 0, 40 and 20 per cent., respectively. In C. lectularius, under similar conditions no mortality was observed in any of these three stages, but it was noticed that adults placed together with examples of C. hemiptera died early.

Daily egg production in both species was greatest at 29°C. and declined more rapidly in *C. hemiptera* as temperature and humidity diverged from the optima. Oviposition ceased more quickly than in *C. lectularius* when feeding was interrupted, and adult longevity was less. At 14°C. [57·2°F.] adults of *C. lectularius* and *C. hemiptera* lived for 326 and 200 days, respectively, without feeding. The former figure was not a maximum, and it is considered that individuals might survive for as long as 600 days.

ROBERTS (J. I.). The Control of Bed Bugs in Railway Coaching Stock by regular HCN Fumigation.—E. Afr. med. J. 14 no. 11 pp. 354—360. Nairobi, February 1938.

Regular fumigation with hydrocyanic acid gas has been carried out for the control of bed-bugs [Cimex] in the rolling stock of the Kenya and Uganda railways for six years with completely satisfactory results. Experiments showed that a coach with a capacity of approximately 3,000 cu. ft. could be effectively fumigated with 12 oz. Zyklon, and that all traces of the gas could be removed by ventilating for two hours and then shunting the train for 15 minutes before bringing it to the main platform. The actual fumigation of a complete set of coaches, such as compose a mail train, was completed in preliminary trials in about 20 minutes. A copy is given of instructions handed to fumigators on railway systems, which show the exact method to be employed for treating the coaches with Zyklon and the precautions to be taken to avoid accidents. Similar experiments were carried out with Celophite Units [cf. R.A.E., B 24 103] when these became available, and complete mortality of the bugs was obtained when 8 oz. (8 disks) were used per coach. Not only was the length of time the fumigators were exposed to the gas much reduced, but the cost was less. One disk is allowed to each four-berth compartment and half a disk each to two-berth compartments, lavatories and bedding cupboards. This method has now been in use for two years, and is reported to give complete satisfaction. The disadvantages of the old method of fumigating with sulphur dioxide are briefly discussed, and the costs of the three methods are compared.

MAZZA (S.) and others. Investigaciones sobre la enfermedad de Chagas. I-III. [Investigations on Chagas' Disease. I-III.]—Publ. Misión Estud. Pat. reg. argent. Jujuy no. 34, 35 pp., 28 figs., 9 refs. Buenos Aires, 1938.

This account of investigations on Chagas' disease in Argentina includes records of *Triatoma infestans*, Klug, infected with *Trypanosoma* (Schizotrypanum) cruzi in the provinces of San Luis, Jujuy and Santa Fé. T. cruzi was also found in Eutriatoma oswaldoi, Neiva and Pinto, and E. sordida, Stål, in Jujuy and in examples of Triatoma platensis, Neiva, taken in birds' nests in Santa Fé. Psammolestes coreodes, Bergroth, was found in birds' nests in San Luis and Jujuy, but was not infected.

MAZZA (S.) & BASUALDO (C.). Caso autóctono de paludismo comprobado en el Dep. Albardon, Prov. San Juan. Presencia de Anopheles pseudopunctipennis en la región. [A Case of indigenous Malaria found in the Department of Albardon, Province of San Juan. The Occurrence of A. pseudopunctipennis in the Region.]—Publ. Misión Estud. Pat. reg. argent. Jujuy no. 35 pp. 17–20. Buenos Aires, 1938.

An account is given of a case of indigenous malaria due to *Plasmodium* vivax in the province of San Luis, Argentina, the patient being one of a gang of workmen building a river bridge. Larvae of *Anopheles* pseudopunctipennis, Theo., were found in clear water in a trench,

and of 22 adults caught in the contractor's house, 19 were females of which one had sporozoites in the salivary glands. A further 6 cases, all among the bridge workers, are recorded in a supplementary note.

I.ANE (J.). Notas sobre investigações entomologicas em localidades onde houve febre amarella sylvestre em São Paulo. |Notes on entomological Investigations in Localities in São Paulo where Rural Yellow Fever has occurred.] Introducção e primeira parte:—
A região da Alta Araraquarense. [Introduction and first Part: The Alta Araraquarense Region.]—Arch. Hyg. Saude publ.
2 pp. 127-133. S. Paulo, 1936. Segunda Parte:—A região da Sorocabana. [The Sorocabana Region.]—Op. cit. 3 pp. 123-130, 1937.

In view of the occurrence in São Paulo of outbreaks of rural yellow fever [cf. R.A.E., B 24 34; 25 65] towards the end of 1935, surveys were made from December 1935 to June 1936 of blood-sucking Diptera in various regions of the state to determine the possible vectors. In the first paper the results are given for the region of the Alta Araraquarense. Those collected comprised 54 mosquitos (all except four taken on man) and two other blood-sucking Diptera. Aëdes aegypti, L., which had occurred in the towns and villages until yellow fever control measures were applied, was not found in the rural areas, but was present in a town of 1,500 inhabitants. Psorophora ferox, Humboldt, and Haemagogus janthinomys, Dyar, were the most frequent and abundant species and are considered to be the most probable vectors in this region [cf. 25 229]. Both have transmitted yellow fever by biting in laboratory experiments [26 65].

The second paper includes a list of 50 Diptera, of which 46 are mosquitos, taken on man in the Sorocabana region, where outbreaks of yellow fever have occurred, chiefly among gangs of lumbermen. The most numerous and widely distributed species, in order of decreasing importance, were Aëdes leucocelaenus, Dyar & Shannon, H. janthinomys, P. ferox, A. nubilus, Theo., or A. serratus, Theo. (or both) and Mansonia chrysonotum, Peryassú; A. aegypti was not

found.

Antunes (P. C. A.) & Lane (J.). Um novo Aëdes, Aëdes (Ochlerotatus) pennai, encontrado em São Paulo.—Rev. Mus. paul. 23 pp. 605-614, 3 pls. S. Paulo, 15th January 1938.

Both sexes and the fourth-instar larva of Aëdes pennai, sp. n., are described from individuals taken in several localities in the state of São Paulo where rural yellow fever was prevalent in 1937. Some of the females had attacked man.

Onchocerciasis in Africa and Central America.—Amer. J. trop. Med. 18 no. 1, Suppl. 136 pp., 72 figs., many refs. Baltimore, Md, January 1938.

This is a report of the studies on onchocercosis in the Belgian Congo, particularly in Lusambo Province, made in 1934 by the second Harvard African Expedition [cf. R.A.E., B 19 1]. It is divided into four parts: the first, by R. P. Strong, deals chiefly with clinical and pathological observations on cases of infestation with Onchocerca volvulus and a

comparison of the findings with those obtained in Guatemala [cf. 23 172]; the second, by J. Hissette, with ocular onchocercosis [cf. 21 85]; and the third, by J. H. Sandground, with helminthological observations, including data on Onchocerca in animals in the Province of Elizabethville and Northern Rhodesia. In the fourth, by J. Bequaert, notes are given on the 20 species of Simulium that occur in the Belgian Congo [cf. 24 276]; they include S. damnosum, Theo., and S. neavei, Roub., which are known to be efficient vectors of O. volvulus, and S. adersi, Pom., S. kauntzeum, Gibbins, S. nigritarsis, Coq., and S. wellmani, Roub., which are reported to bite man.

DE MEILLON (B.). A Note on Anopheles gambiae and Anopheles funestus in Northern Rhodesia.—Publ. S. Afr. Inst. med. Res. no. 40 pp. 306–312, 1 map, 9 refs. Johannesburg, November 1937.

Since measures against Anopheline larvae apparently had little effect on the numbers of adults of *Anopheles gambiae*, Giles, and *A. funestus*, Giles, that occurred in habitations in a township in Northern Rhodesia, observations were carried out on the flight range of stained adults.

The following is taken from the author's conclusions: A. gambiae and A. funestus show little tendency to fly against the wind; with it, they can cover comparatively great distances, A. gambiae being found to fly two miles in a single night. At least in a slight breeze, they do not fly close to the ground and so are not hindered by dense bush of an average height of 20–30 feet. Under conditions such as prevail in this locality, larval control measures carried out within half a mile of the township are inadequate to prevent the occurrence of malaria.

De Meillon (B.). Some Reactions of Anopheles gambiae and Anopheles funestus to environmental Factors.—Publ. S. Afr. Inst. med. Res. no. 40 pp. 313–327, 3 figs., 14 refs. Johannesburg, November 1937.

Details are given of experiments to test the reactions of Anopheles gambiae, Giles, and A. funestus, Giles, to various humidities, and to light and shade. The apparatus used is described and illustrated. When the mosquitos were in a trough in which the humidity rose gradually from one end to the other, they showed a tendency to congregate in the damper half of the trough when they had been starved for 24 hours or maintained for some hours in low humidities, but there was no significant reaction for some time after they had fed on sugar-water or blood. From these experiments it would seem that, if A. gambiae can obtain a blood meal every 24 hours, the humidity of its environment has no effect on it. Tests to determine the ability of both species to feed on blood at different humidities were inconclusive, but showed that A. gambiae, at least, will feed at very low humidities (10-18 per cent.) at a fairly high temperature (28°C. [82·4°F.]). A. funestus could survive after a blood meal for at least 24 hours at a humidity of 20 per cent. and a temperature of 26°C. [78·8°F.].

When shade (which was provided by a black cloth) was removed from the end of the trough where adults of A. gambiae were resting

to the other end, more of the mosquitos remained in the light than moved to the shade. A similar result was obtained when gravid females of A. funestus were used. If the adults were undisturbed they rested in the light apparently for an indefinite length of time. When the adults were disturbed and the shade rapidly placed over one end of the trough while they were still in flight, more of them settled in the shaded part. Towards evening the adults became active without any apparent external stimulus and at this time they did not show a negative reaction to light.

Messerlin (A.) & Treillard (M.). Sur une nouvelle station du groupe Myzomyia S. S. (anophéline) en Afrique du Nord: A. (Myzomyia) sergenti Theobald au Maroc occidental.—Bull. Soc. Path. exot. 31 no. 2 pp. 106–109, 1 fig. Paris, 1938.

Anopheles sergenti, Theo., is recorded for the first time from Morocco, where it was taken in September and October in a locality about 37 miles from Marakesh. Its taxonomy is discussed, and the characters distinguishing it are briefly noted. In the same locality, large numbers of A. hispaniola, Theo., and smaller numbers of A. maculipennis var. sicaulti, Roub., were present throughout the summer and autumn, and several examples of A. multicolor, Camb., were taken in August. The mosquitos were collected in huts in a native village, where the average density was 15–20 per room and the proportion was 80–90 per cent. of A. hispaniola and 20–10 per cent. of A. maculipennis var. sicaulti and A. sergenti.

Messerlin (A.). L'Aëdes mariae au Maroc occidental.—Bull. Soc. Path. Exot. 31 no. 2 pp. 110-115, 8 figs. Paris, 1938.

In 1937, a species of Aëdes was taken in Morocco, the adults of which resembled those of A. mariae, Ed. & Et. Serg., and the larvae those of A. desbansi, Séguy [cf. R.A.E., B 15 71] and A. dzeta (which like A. epsilonn was described from larvae by Séguy in 1924). From an examination of large numbers of the larvae, which were taken in July from salt pans near Rabat, it is concluded that the differences in their characters and those of A. desbansi, A. dzeta and A. mariae are so slight that all these should be treated as variants, possibly regional, of A. mariae. Certain characters of the larvae of A. epsilonn are sufficiently well-defined for it to be regarded as distinct. A. zammittii, Theo., is considered a synonym of A. mariae [cf. 20 213].

GASCHEN (H.) & NGUYEN-NGUYEN. Présence de phlébotomes en Indochine Sud.—Bull. Soc. Path. exot. 31 no. 2 pp. 115-117, refs. Paris, 1938.

Phlebotomus barraudi, Sinton, P. bailyi var. campester, Sinton, P. stantoni, Newstead, and P. sylvestris, Sinton, were identified in material collected in Cochin China and Cambodia. Sandflies seem to be more generally distributed there than in the north of Indo-China, since they were taken in the plains as well as in the hilly regions [cf. R.A.E., B 25 221]. They were found in the same types of habitat.

Treillard (M.). Résultats expérimentaux sur la longévité comparée, chez diverses espèces anophéliennes de l'Indochine méridionale.—
Bull. Soc. Path. exot. 31 no. 2 pp. 117-122, refs. Paris, 1938.

A table shows the average longevity of females of each of eight species of Anophelines reared and kept under similar conditions in the laboratory. Two further tables, given as examples, show the details for two dissimilar species, A. minimus, Theo., and A. vagus, Dön. The former, which breeds in clear running water and is anthropophilous, domestic and a vector of malaria, lives 5–10 times as long as the latter, which breeds in stagnant, often very polluted, water, is domestic but zoophilous, and does not transmit malaria.

JOYEUX (C.) & SAUTET (J.). Nouvelles recherches sur Dirofilaria immitis (Leidy).—Bull. Soc. Path. exot. 31 no. 2 pp. 122-123, 2 refs. Paris, 1938.

With a view to discovering the normal insect host of Filaria (Dirofilaria) immitis in Camargue, surveys were undertaken during the summer months on farms where infected dogs had been observed. Anopheles maculipennis Mg. (represented by races atroparvus, van Thiel, cambournaci, Roub. & Treill., messeae, Flni., and melanoon, Hackett) was found in large numbers in the cow-sheds, hutches and fowl houses. The results of the survey, which is not yet completed, indicate that the incidence of the filariasis is correlated with the density of this Anopheline. No naturally infected examples have yet been found. Experimentally the races all appeared to be susceptible to infection, but females that were allowed to feed on infected dogs died in 2-3 days from a too intense multiplication of the parasites; their malpighian tubes were filled with microfilariae that had not yet reached the sausage Dissection of examples of the flea, Ctenocephalides (Ctenocephalus) canis, Curt., from an infected dog revealed microfilariae that had not reached the sausage stage in the stomach of 2 per cent. They remained alive for a certain length of time and then degenerated. Their length increased to 425µ. None was seen in the malpighian Similar results were obtained with adults of Rhipicephalus sanguineus, Latr., taken on an infected dog. In experiments microfilariae were found in three out of 100 larvae of this tick that had engorged on an infected dog. Their development ceased after they had reached a length of 250-275 \mu. In both adults and larvae of Triatoma infestans, Klug, the parasites reached a more advanced stage of development. Sausage forms measuring 200 by 12 u were seen at the end of 5 days, and at the end of 15 days one was found in the proboscis. On the other hand many parasites degenerated in this bug, and none was observed in the malpighian tubes.

Trensz (F.). Le paludisme en Alsace (aperçu historique).—Arch. Inst. Pasteur Algérie 15 no. 4 pp. 440-449, 34 refs. Algiers, 1937.

From a review of available data it is concluded that endemic malaria in Alsace increased in prevalence during the first half of the nineteenth century, decreased during the second half and finally disappeared between 1880 and 1890. In the first half of the century numerous public works, such as the construction of railways, the digging of canals, etc., were carried out; towards the end there was an improvement in the standard of living of the population. It was

suggested by H. Kunlin that the increased incidence of malaria was due to the importation of the parasite from Italy by the large number of Italian workmen employed in the work of making terraces, constructing dikes along the Rhine, etc. This hypothesis is plausible but does not appear to afford a complete explanation, for Italian workmen have been employed in Alsace until quite recent times and malaria has not reappeared. Anopheline breeding places are still abundant along the Rhine valley in spite of the embankments, which do not prevent the water table from rising annually so that large stretches of country by the side of the river are flooded. A recent survey has shown that the villages beside the river are still heavily infested with Anophelines, which, however, are almost exclusively Anopheles maculipennis, Mg., race messeae, Flni., which is zoophilous and of little importance as a vector. Although this finding would explain the absence of the disease at the present time, it does not explain its prevalence in the past, unless one race of A. maculipennis has replaced another or the original race has changed its instincts and morphology; in this connection it is pointed out that well-stabled cattle have been present in the affected villages throughout the century. It seems probable that, as in other parts of France, the disappearance of malaria was due to the effects of a number of complex factors, such as the execution of public health works, the administration of quinine, the improvement of conditions of hygiene, and the raising of the standard of living.

SÉGUY (E.). Etude comparée des réactions des moustiques et de leurs larves placés sous l'influence des rayons lumineux monochromes.—

Bull. Ass. Nat. Loing 18 no. 3-4 pp. 140-151. Moret-sur-Loing,
June 1936. [Recd. 1938.]

Investigations in France in 1931–35 on the responses to coloured light of adults of eight species of mosquitos taken in Fontainebleau showed that almost all reacted violently to bright light, independently of colour. The reaction was less intense when the light was dark green, dark blue, violet or purple. In bright light from pale red to orange and from violet to white, mortality was rapid. No violent reactions were observed in the larvae, except in those of *Culex pipiens*, L., and *Theobaldia annulata*, Schr., which died in bright light, even if it was sunlight.

Henkel (H.). Die Beseitigung einer Stechmückenplage nebst einem Beitrag zur Frage des Stechens von Culex pipiens. [The Elimination of a Plague of Mosquitos and a Note on the Question of Biting by C. pipiens.]—Arch. Schiffs- u. Tropenhyg. 42 pt. 3 pp. 124-131, 1 map, 7 refs. Leipzig, March 1938.

Much of the information in this paper on the summer outbreaks of mosquitos at Hildesheim, in the province of Hanover, has already been noticed [R.A.E., B 21 121; 26 13]. The treatment by draining and spraying of the breeding places of Aëdes vexans, Mg., with which A. caspius, Pall., was associated, kept the town free from annoyance in 1936 and 1937. Culex pipiens, L., which, prior to the author's studies,

had been thought to be responsible for the trouble, was still very numerous in the town after it had ceased. Observations there showed that it did not attack man.

ROBERTSON (R. C.) & CHANG (Teh-ling). Rice Cultivation in Relation to Malaria.—China J. 26 no. 6 pp. 347–360, 8 pls., 2 figs. Shanghai, June 1937. [Recd. 1938.]

An account is given of the relation between rice cultivation and the breeding of *Anopheles hyrcanus* var. *sinensis*, Wied., the local vector of malaria, in the Kaochiao district of Shanghai [cf. R.A.E., B **24** 46], based on observations in 1934–35. Of irrigation ditches, stagnant pools, and flooded rice-fields, 31·2, 33·8 and 70·9 per cent., respectively, contained larvae of this Anopheline, the average number of larvae per square metre in them being 8·4, 15·4 and 27. The larvae were confined to edges of ditches and pools, except where the surface was covered with aquatic vegetation, but tended to spread over the whole surface of the rice-fields. They were more numerous in pools and ditches at the beginning and end of the season, and in the rice-fields in the middle of summer, when most of the vegetation was cleared from the former for use as green manure and they were reduced by lack of rain.

In the area under observation, the larvae were present in 64.5 per cent. of the fields into which the rice was transplanted from nurseries and in 77.6 per cent. of those in which it was sown broadcast, and their density per square metre was 21.2 and 33.4, respectively. increased frequency in the sown fields was due to the fact that the preparation of the soil in them begins in mid-April, a month earlier than in those in which the rice is transplanted. The method of transplanting is the more profitable. During the preparation of the fields, which lasts about a month, breeding is inhibited at first by lack of water and later by the turbidity caused by ploughing, which kills first- and second-instar larvae, and the pollution of the water by green manure. At the beginning of May, none of 24 nursery beds contained larvae, but at the end of that month all did so. This was due to the fact that as the rice shoots grow up, the water is allowed to rise to about 5 ins. and becomes clear. Breeding is thus rendered possible, but it is gradually restricted to the edges as the rice grows higher.

A comparison of the various fertilisers in use showed that green manure, night soil and stable manure inhibited the breeding of the Anopheline by polluting the water, and that compost manure, which is a mixture of silt from the canals, ashes and organic matter, and oilcake fertiliser did not affect it to any great extent. Hoeing and weeding the fields eliminated most of the larvae owing to the resulting turbidity. Counts in early June showed averages of 84.6 and 110.89 larvae per square metre in 1934 and 1935, respectively, but at the beginning of July, after hoeing and weeding, these figures were 0.15 and 20.4.

Breeding again increases during the flowering of the rice, which lasts about a fortnight and during which the water must not be disturbed, but occurs mostly at the edges of the fields. This may be due to the shaded conditions of the central area. After the harvest, breeding in the fallow fields is dependent on rainfall.

Methods of control are considered, such as dusting with Paris green, intermittent drainage of the fields, the introduction of *Gambusia*, and the restriction of rice cultivation, but it is concluded that in this

district they are either impracticable or would involve the farmers in too much expense. The use of green manure and frequent hoeing should, however, be encouraged.

YAO (Y. T.) & We (C. C.). One Year's Observations of A. hyrcanus var. sinensis in Nanking, 1933. —Trans. 9th Congr. Far East. Ass. trop. Med. 2 pp. 3-26, 2 figs., 12 refs. Nanking, 1935. [Reed. March 1938.]

The following is taken from the authors' summary: Throughout systematic observations lasting one year (1933), the only species of Anopheles found in Nanking was A. hyrcanus var. sinensis, Wied. It occurred in many different types of breeding place, but preferred those with much vegetation and sunshine, and with water that was still and clear and had a pH of 7·2-7·4. Large numbers of females were caught in cow-sheds and in sheds where man and animals were sleeping together. They appeared to prefer animal to human blood [cf. R.A.E., B 25 203]. Larvae were first observed in April and adults in May. Both increased in numbers until June, when the larvae decreased somewhat, but these were again numerous in August. The peak of the adult population occurred in July. The numbers of larvae and adults decreased from September and were at a minimum in December. The seasonal distribution of adults and larvae was primarily dependent on temperature and only secondarily on rainfall and humidity. Of 6,455 females that were dissected, only 6 contained oöcysts, and of 54 laboratory-bred females that were allowed to feed on carriers of all three types of malaria, only 3 of the 13 fed on cases of benign tertian [Plasmodium vivay] developed oöcysts. The maximum number of eggs deposited by a female was 390 and the minimum 12. The egg is described.

Jackson (R. B.). The Anophelines of the Colony of Hong Kong.— Trans. 9th Congr. Far East. Ass. trop. Med. 2 pp. 27-36. Nanking, 1935. [Recd. March 1938.]

A detailed account is given of observations in 1932-34 on the Anophelines of Hong Kong, most of the information in which has already been noticed from subsequent papers by the author [R.A.E., B 25 97]. He concludes that Anopheles minimus, Theo., and A. jeyporiensis [var. candidiensis, Koidz.] are the most important vectors of malaria in the Colony. They breed in hill country throughout the year, the former in streams and irrigation ditches and the latter in rice-fields. The range of flight of A. jeyporiensis exceeds half a mile. A. hyrcanus var. sinensis, Wied., and A. maculatus, Theo., can be vectors of malaria only in exceptional circumstances.

Toumanoff (C.). Etude de l'indice maxillaire de Roubaud en tant que méthode pratique d'investigation sur les aptitudes trophiques des espèces anophelinennes d'Extrême-Orient. —Trans. 9th Congr. Far East. Ass. trop. Med. 2 pp. 37-51, 6 figs. Nanking, 1935. [Recd. March 1938.]

The author states that further work on the maxillary indices of the Anophelines of Tonkin and Cochin China has confirmed the indices previously given [R.A.E., B 21 140] for Anopheles hyrcanus var. sinensis, Wied., A. vagus, Dön., A. minimus, Theo., A. jeyporiensis,

James, A. aconitus, Dön., and A. maculatus, Theo. The multidentate character of the first [cf. 24 47] was very evident, as in northern and southern Cochin China 92.9 and 86 per cent., respectively, of individuals taken had indices of over 14. The investigations also showed that the indices for A. annularis, Wulp (fuliginosus, Giles), A. kochi, Dön., A. splendidus, Koidz. (maculipalpis, auct.) and A. philippinensis, Ludl., were 10.9, 11.6, 11.6, and 11.2, respectively, in Tonkin, and, omitting the second, 11.5, 11.8 and 11.4 in Cochin China [cf. 23 81]. These species are all known to be vectors of malaria. The figures for A. subpictus, Grassi, A. tessellatus, Theo., and A. sundaicus, Rdnw., in Cochin China were 14.3, 12.4 and 13.7, and for the first two in Tonkin 12.9 and 12.0, respectively. Investigations on A. barbirostris, Wulp, A. vagus and A. subpictus showed that differences in size did not imply differences in maxillary index, and that small-sized individuals might have high indices.

Williamson (K. B.). Need for Action in Relation to the biochemical Investigation of Anopheline Breeding Places.—Trans. 9th Congr. Far East. Ass. trop. Med. 2 pp. 83-87, 5 refs. Nanking, 1935. [Recd. March 1938.]

The author emphasises the importance of research on the chemical constitution of the water and soil in Anopheline breeding places [cf. R.A.E., B 18 34; 25 69]. He considers that the biochemical fitness of water for different mosquitos is determined by the balance between oxidisable (and especially putrescible) organic matter and the oxidising capacity of the water. Single so-called factors, such as ammonia or oxygen, roughly indicate the balance, but they do so imperfectly.

YAO (Y. T.) & Wu (C. C.). Antilarval Measures by the Use of Paris Green in a selected Area of Nanking.—Trans. 9th Congr. Far East. Ass. trop. Med. 2 pp. 213-221, 7 refs. Nanking, 1935. [Recd. March 1938.]

An account is given of an experiment on the effectiveness of Paris green against larvae of *Anopheles hyrcanus* var. *sinensis*, Wied., in a selected area in Nanking between August and December 1933. A 1 per cent mixture of Paris green and road dust was applied to the surfaces of all ponds in the area and considerably reduced the incidence of both adults and larvae as compared with control areas. The cost of the operation is discussed.

Russell (P. F.). The automatic Distribution of Paris Green for Control of Anopheles Larvae.—Trans. 9th Congr. Far East. Ass. trop Med. 2 pp. 223–232, 2 pls., 2 figs., 5 refs. Nanking, 1935. [Recd. March 1938.]

The results are given of tests of an apparatus previously described [R.A.E., B 22 223] for distributing dusts containing Paris green in streams against Anopheline larvae. The machines were erected on a stream 1–2 yds. wide in Laguna (Philippines), that represented a typical breeding place of Anopheles minimus var. flavirostris, Ludl., and A. barbirostris, Wulp, and a 1 per cent. mixture of Paris green and powdered charcoal was used. In a test in which counts of

larvae were made before and 1 hour after the cessation of treatment, which lasted 24 hours, the average number of Anopheline larvae per dip was reduced from 575.6 to 163.4. In another, in which the second count was taken 25 hours after the machine had emptied, this average fell from 465 to 21. The machine proved satisfactory and did not clog.

PAPERS NOTICED BY TITLE ONLY.

- Buxton (P. A.). Studies on the Growth of Pediculus [humanus, L.] (Anoplura).— Parasitology 30 no. 1 pp. 65–84, 7 figs., 33 refs. London, 25th February 1938.
- Womersley (H.). A Revision of the Australian Trombididae (Acarina).—Rec. S. Aust. Mus. 6 no. 1 pp. 75–100, 3 figs. Adelaide, November 1937,
- Schulze (P.). Die kleinhöhlenbewohnenden Zecken der Artengruppe um Ixodes autumnalis Leach 1815. Ticks of the Ixodes autumnalis Group inhabiting small Cavities (with a key to German species and descriptions of two that are new).]—Z. Parasitenk.

 9 no. 3 pp. 351-372, 13 figs., 13 refs. Berlin, 1937. [Cf. R.A.E., B 18 64.]
- Wagner (J.). Aphaniptera aus Süd-Peru sowie Bemerkungen über die Familie Stephanocircidae Wagn. Ausbeute der Peru-Reise von Prof. Dr. E. Titschack (Hamburg) im Jahre 1936. [Siphonaptera from southern Peru together with Remarks on the Stephanocircids. Those taken (including one new genus and two new species from rodents) during Prof. Titschack's Peruvian Expedition in 1936.]—Z. Parasitenk. 9 no. 6 pp. 698-716, 15 figs. Berlin, 1937.
- Wagner (J.). Eine neue Art "helmtragender" Flöhe aus Bolivien.
 [A new genus and species of Stephanocircid flea from a bird in Bolivia.]—Z. Parasitenk. 10 no. 1 pp. 132–137, 2 figs. Berlin, 1938.
- DA COSTA LIMA (A.). Uma variedade de Rhopalopsyllus bohlsi [var. jordani, n., on rodents in Brazil] (Siphonaptera: Pulicidae).—
 Rev. med.-cirurg. Brasil 45 no. 2 repr. 6 pp., 3 figs., 2 refs. Rio de Janeiro, August 1937. [Recd. 1938.]
- DA COSTA LIMA (A.). Um novo Anopheles da Baixada Fluminense (Diptera: Culicidae). [Anopheles evandroi, sp. n., described from a female from S. Bento, State of Rio, Brazil.]—Rev. med.cirurg. Brasil 45 no. 1 repr. 5 pp., 2 figs. Rio de Janeiro, July 1937. [Recd. 1938.]
- Lane (J.) & Antunes (P. C. A.). Nota sobre o genero Mansonia, sub-genero Rhynchotaenia, com a descripção de uma nova especie [M. (R.) shannoni, sp. n., from Brazil].—Rev. Mus. paul. 23 pp. 224-232, 9 refs. S. Paulo, 27th October 1937.
- RICHINS (C. A.). The Metamorphosis of the Digestive Tract of Aëdes dorsalis Meigen.—Ann. ent. Soc. Amer. 31 no. 1 pp. 74-87, 3 pls., 1 fig., 28 refs. Columbus, Ohio, March 1938.
- Scharff (J. W.). Anti-mosquito Measures in the Northern Settlement of Malaya [a general survey].—Trans. 9th Congr. Far-East. Ass. trop. med. 2 pp. 201-212, 5 pls. Nanking, 1935. [Recd. 1938.] [Cf. R.A.E., B 23 233.]

- ZUMPT (F.). Die Gefahr der Gelbfieberverbreitung durch den Luftverkehr. [The Danger of Spread of Yellow Fever by Air Traffic (a review of the literature, particularly on the carriage and control of mosquitos in aeroplanes).]—Festschr. Nocht 1937 pp. 699-704, 1 map, 11 refs. Hamburg, 1937.
- DE MEILLON (B.). The Eggs of some South African Anophelines. Part III. [Anopheles squamosus var. cydippis, De Meillon.]—Publ. S. Afr. Inst. med. Res. no. 40 p. 305, 2 figs. Johannesburg, November 1937. [Cf. R.A.E., B 25 16.]
- DE MEILLON (B.). Ceratopogonidae. 1. Records and Species from the Belgian Congo [including 2 new species].—Publ. S. Afr. Inst. med. Res. no. 40 pp. 328-331, 2 figs. Johannesburg, November 1937. 2. Records and Species from South Africa [including 16 new species].—T.c. pp. 328-385, 108 figs. 3. The Structure of the Pharynx and Oesophageal Pump in Females of certain Genera of Ceratopogonidae.—T.c. pp. 386-392, 20 figs., 1 ref.
- DE MEILLON (B.). Simulidae. 1. New Species from South Africa.—
 Publ. S. Afr. Inst. med. Res. no. 40 pp. 393–402, 24 figs.
 Johannesburg, November 1937.
- DE MEILLON (B.). Siphonaptera. 1. New Species from South Africa [records of 4 species, including 2 new ones, from rodents].—
 Publ. S. Afr. Inst. med. Res. no. 40 pp. 403–408, 12 figs. Johannesburg, November 1937.
- CAUSEY (O. R.). Culicoides of Siam with Descriptions of new Species.—
 Amer. J. Hyg. 27 no. 2 pp. 399-416, 8 pls., 14 refs. Baltimore,
 Md, March 1938.
- THOMPSON (G. B.). The Hippoboscidae (Diptera) recorded from Ceylon.—Ann. Mag. nat. Hist. (11) 1 no. 3 pp. 315-319, 1 pl., 1 fig. London, March 1938.
- PARROT (L.) & LE GAONACH (J.). Notes sur les phlébotomes. XXVI.

 Présence de Phlebotomus perniciosus Newst. dans Le Hoggar
 (Sahara central).—Arch. Inst. Pasteur Algérie 15 no. 4 p. 633.
 Algiers, 1937.
- ZANDER (E.). Ueber Chloropiden-Schwärme in Erlangen. [A record of the invasion of a house by *Chloropisca* sp. with notes on similar cases in Germany.]—Anz. Schadlingsk. 14 pt. 2 pp. 21–23. Berlin, February 1938. [Cf. R.A.E., B 22 60; 23 270; etc.]
- Dampf (A.). Los Ceratopogónidos o jejenes (Insecta, Diptera, Fam. Ceratopogonidae) como transmisores de Filarias. [Ceratopogonids as Vectors of Filarias (possible relation of *Culicoides* to *Onchocerca caecutiens* in Mexico,]—*Medicina* no. 268, repr. 7 pp., 3 figs., 7 refs. Mexico, D.F., 25th May 1936. [Recd. 1938.] [For French translation see R.A.E., B 25 57.]
- COLCORD (M.). Index V to the Literature of American Economic Entomology January 1, 1930 to December 31, 1934.—Amer. Ass. econ. Ent., Spec. Publ. 5, [12–693 pp.—College Park, Md, 1938.

La Face (L.). Osservazioni sul C. pipiens autogenicus.—Riv. Parassit.

2 no. 1 pp. 1-12, 20 refs. Rome, January 1938. (With Summaries in French, English and German.)

The literature on *Culex pipiens* race *autogenicus*, Roub., is briefly reviewed [cf. R.A.E., B **21** 266; **24** 98, etc.]. In order to ascertain if in Italy this race has the same biological behaviour as elsewhere, four females from an Italian strain maintained in Rome were isolated in 1936 and fed on sparrows' blood. Their progeny was observed

through nine generations.

The autogenous capacity of the females varied considerably, without any clear relation to the food of the larvae [cf. 19 215], not merely in successive generations, but also in females of the same generation. For instance, in females of the fourth generation derived from larvae all fed on dried blood, the percentage that oviposited varied from 0 to 68.4. Some females oviposited when given water but no food. Others that did not oviposit when given water only, did so after feeding on milk or blood. The proportions of the sexes did not vary greatly from equality when all generations were reckoned, but irregular variations occurred within the generations.

CORRADETTI (A.). Descrizione di una specie anofelica a distribuzione asiatica rinvenuta in Africa Orientale Italiana: Anopheles (Myzomyia) dthali Patton, 1905. [Description of an Asiatic Anopheline, A. d'thali, found in Italian East Africa.]—Riv. Parassit. 2 no. 1 pp. 49-54, 4 figs., 1 pl., 3 refs. Rome, January 1938. (With Summaries in French, English and German.)

A note is given on the geographical distribution of *Anopheles d'thali*, Patton, and the fourth-instar larva and adults of both sexes are described from material taken in the Semien region of Abyssinia. This Anopheline has also been found in Eritrea [cf. R.A.E., B **26** 67].

CORRADETTI (A.). Ricerche sperimentali sulle preferenze alimentari delle varietà di Anopheles maculipennis. [Experimental Research on the Food-preferences of the Varieties of A. maculipennis.]—
Riv. Malariol. 16 (1) no. 6 pp. 419-433. Rome, 1937. (With a Summary in English.)

To ascertain the food-preferences of races of Anopheles maculipennis, Mg., among which the author includes A. sacharovi, Favr (maculipennis var elutus, Edw.), batches of newly emerged mosquitos were given daily opportunities of feeding on a host (man, ox, pig, donkey, rabbit or fowl), the mosquitos that had fed being removed each day for 5 days. The results were as follows: For race labranchiae, Flni., the total percentage of females that fed during the 5 days were 98.3 on man and 97.8-97.3 on the other hosts, and the percentages were highest on the first two days. For A. sacharovi, the total percentages were 97.9 on man, 95.8-88.6 on the other mammals, and 77.5 on fowl. The percentages were highest on the first two days on mammals and on the second and third days on fowls. For race atroparvus, van Thiel, the total percentages on ox, man, rabbit, fowl, pig and donkey were 89.5, 89.4, 82.7, 80.0, 75.9 and 73.0. The percentages were highest on the second and third days on donkey and on the first two days on the other hosts. For race maculipennis (typicus), the total percentages were 81.2 on ox, 52.2 on man, and less on the other hosts;

he percentages on all hosts were highest on the second and third days. For race *melanoon*, Hackett, the total percentages were 69.8 on ox, 38 on man and 30-42.5 on the other hosts. The percentages were highest on the first two days on ox, and on the second and third on the other hosts.

DEL VECCHIO (G.). Contributo allo studio dell'Anopheles algeriensis e dell'A. claviger.—Riv. Malariol. 16 (1) no. 6 pp. 434-436. Rome, 1937. (With a Summary in English.)

From examinations of thousands of eggs of Anopheles algeriensis, Theo., and A. claviger, Mg., collected in September-November 1937 in the province of Littoria (Italy), the author finds that in this region there are two races of A. algeriensis, one with egg characters as shown in a figure by Ed. Sergent reproduced by Edwards [R.A.E., B 10 17] and the other with those figured and described by La Face [18 64]. The eggs of A. claviger resembled the figure given by Edwards [loc. cit] but had an important differential character, a small intermedial costa in the intercostal spaces of the floats. This has also been noted by Et. Sergent in a paper on the Anophelines occurring in brackish water on the coast of Algeria [24 311].

Sandicchi (G.). Anopheles plumbeus nel suburbio di Roma.—Riv. Malariol. 16 (1) no. 6 pp. 437-440, 3 figs., 2 refs. Rome, 1937. (With a Summary in English.)

Adults of *Anopheles plumbeus*, Steph., were taken in the darkest part of a badly lit stable in the suburbs of Rome, and a breeding place was discovered nearby in a small, dark cavity close to a wall. The water was somewhat dirty and full of débris and had a constant temperature of about 10°C. [50°F.]. In the laboratory, the larvae developed to the adult stage in 24 days, the pupal period taking 4 days. Of 20 females of *A. plumbeus* fed on carriers of gametocytes of *Plasmodium vivax*, 2 became infected.

NERI (P.). Il potere infettante degli sporozoiti di Plasmodium relictum prima del loro ingresso nelle ghiandole salivari. [The infective Power of Sporozoites of P. relictum prior to their Entry into the salivary Glands.]—Riv. Malariol. 16 (1) no. 6 pp. 461–464. Rome, 1937. (With a Summary in English.)

The author inoculated 24 canaries with sporozoites of *Plasmodium relictum* obtained from the stomach cysts and the body cavity of Culex, and 19 became infected. These results confirm previous work by Missiroli and contradict those published by Jerace [R.A.E., B...] **26** 68].

LÖRINCZ (F.). Malaria in Hungary.—Riv. Malariol. 16 (1) no. 6 pp. 465–479, 4 refs. Rome, 1937. (With a Summary in Italian.)

Malaria in Hungary is not very severe, but its incidence has been increasing in recent years. Of the cases reported from 1927 to 1936,

80 per cent. occurred in two endemic regions, in the north-east and south-west, which comprise about one-fourth of the area and one-sixth of the population of the country. Of positive smears, 91 per cent. were Plasmodium vivax, 8 per cent. P. falciparum and 1 per cent. P. malariae. Of several thousand Anophelines taken in dwellings and animal quarters, all were Anopheles maculipennis, Mg., except one individual of A. claviger, Mg. (bifurcatus auct.) and two of A. hyrcanus, Pall. Examination of eggs laid by 2,582 females of A. maculipennis collected in 10 different stations in 1936 showed that 30.9 per cent. belonged to race maculipennis (typicus), 57.7 per cent. to race messeae, Flni., and 11.3 per cent. to race atroparvus, van Thiel. The distribution of these races in houses and animal quarters in the various areas is shown in a table. Races maculipennis and messeae were predominant in the endemic zones, and malaria infection was found in both of them. Race atroparvus occurred mainly in the comparatively non-malarious central plain, where it was associated with slightly brackish water.

Knowles (R.) & Basu (B. C.). Atmospheric Temperature and Humidity with Reference to Transmission of Malaria by Anopheles stephensi (Abstract).—Proc. Indian Sci. Congr. 23 pp. 492-493. Calcutta, 1936. [Recd. March 1938.]

A summary is given of laboratory experiments in Calcutta to determine the effect of atmospheric temperature and humidity on the transmission of malaria (*Plasmodium falciparum*, *P. vivax* and *P. malariae*) by *Anopheles stephensi*, List. Batches of laboratory-bred females were fed on gametocyte carriers and exposed to 36 different combinations of temperature and relative humidity in an air-

conditioning cabinet.

The following is taken from the authors' conclusions: At 50°F. and all humidities between 50 and 100 per cent., no infection was obtained with any species of Plasmodium, whereas control experiments at room temperature showed salivary gland and gut infections with P. vivax and P. falciparum and gut infection with P. malariae. At 100°F. and humidities between 50 and 100 per cent., A. stephensi does not survive long enough to become infective. Infection occurred with *P. falciparum* between 70 and 90°F, and humidities between 50 and 100 per cent., and the salivary glands were frequently infected. At 60°F., very few mosquitos were infected at 60 per cent. humidity and none at other humidities. Infection with P. vivax occurred at 60-90°F, and generally with humidities between 70 and 100 per cent. The heaviest salivary gland infections were obtained at 80°F. No salivary gland infections were obtained with P. malariae. Gut infection was observed between 60 and 90°F., the heaviest being at 70°F. Heavy infections were generally found at the higher The maturity and number of the gametocytes in the donor's blood play an important rôle in the infection of the mosquito. In some of the engorged females, especially in the case of P. falciparum, oöcysts packed with sporozoites were found developing towards the lumen of the mid-gut; such oöcysts would rupture into the gut, and the mosquitoes concerned could not be infective. Under these experimental conditions, the numbers of A. stephensi that survived were greatest at low temperatures and high humidities.

MENON (K. P.) & SEETHARAMA IYER (P. V.). The Viability of the "infective" Forms of the Larvae of Wuchereria bancrofti when freed from the Mosquito Host (Abstract).—Proc. Indian Sci. Congr. 23 pp. 493–494. Calcutta, 1936. [Recd. March 1938.]

Experiments in India showed that infective forms of *Filaria* (*Wuchereria*) bancrofti taken from their mosquito hosts survived in saline for a considerable time, in plain tap-water for $4\frac{1}{2}$ – $6\frac{1}{2}$ hours, and in $0\cdot 2$ per cent. hydrochloric acid with different concentrations of starch and egg-albumen for 20–45 minutes. Filarial infections might therefore be contracted by means other than mosquito bites.

Watson (R. B.), Kiker (C. C.) & Johnson (H. A.). The Role of Airplane Dusting in the Control of Anopheles Breeding associated with Impounded Waters.—Publ. Hlth Rep. 53 no. 7 pp. 251–263, 4 pls., 1 fig. Washington, D.C., 18th February 1938.

The Division of Malaria Studies and Control was organised by the Tennessee Valley Authority to carry out a comprehensive programme of research on the malaria associated with impounded waters and its control. During the past three years investigations have been undertaken on the development of cheaper materials and methods of applying them for the control of larvae of Anopheles quadrimaculatus, Say, the only proved natural vector in the Tennessee Valley. In the present report, an account is given of the results obtained by the application of Paris green from aeroplanes. Experience during the past two years has confirmed the conclusion reached in 1935 that aeroplane dusting is not practicable for breeding areas of limited extent along a tortuous shoreline, but that it offers a promising method of applying dust to large expanses of water [cf. R.A.E., B 25 117]. In the first part of the paper, the physical and biological changes that occur when an artificial lake is formed are discussed, and descriptions are given of the two aeroplanes used, the apparatus for carrying and distributing the dust, and the details of its application. A dust composed of 10 per cent. by volume of Paris green in soapstone applied at the rate of about $\frac{1}{2}$ lb. per acre and assuming a lethal dust path 200 ft. wide did not give uniformly satisfactory results, but practically all larvae except those protected by dense vegetation were killed when the proportion of Paris green was raised to 20 per cent. On three occasions dead larvae were found in mats of algae 30 minutes after dusting, and dissection revealed particles of Paris green in their guts. In 1937, the aeroplanes flew at an average altitude of 20 ft... since at this altitude the dust cloud could be more accurately placed and it was believed that when the aeroplane flies low over densely overgrown breeding places the blast from the propeller tends to blow the dust through the vegetation. Figures are given for the season from the middle of May to the end of September 1937 showing the extent of the area treated, the amount of dust applied, the flying time, and the approximate cost of the treatment per acre for one of the aeroplanes.

Since in certain situations efficient results were not secured, experiments were carried out in 1937 on a small natural spring-fed swamp in a portion of the Wheeler Reservoir, where a more critical examination of the operations could be made, and a detailed account of these is given in the second part of the paper. From the first experiment, it was concluded that almost all larvae were killed in

an area containing grasses, sedges and lilies, when a dust containing 28.4 per cent. by weight of Paris green was applied from an altitude of 20 ft. at a rate of ½-1 lb. Paris green per acre. In the densely overgrown part of the area, the larval mortality was from 53 to 72 per cent. In the area in which the most effective results were obtained, the width of the swath was at least 300 ft., which corresponds to an average distribution of less than 0.5 lb. Paris green per acre. In the second experiment, in which a dust containing the same concentration of Paris green was applied from a height of 6-10 ft. at the rate of 1-1.2 lb. Paris green per acre, the mortality was low (50 per cent. or less), although large numbers of particles of Paris green per square inch were found on glass slides placed on the line of flight; it is suggested that some factor connected with extremely low flying or the brisk cross wind may have been responsible for the low mortality. There was no apparent difference in the power of Paris green to kill larvae when the ordinary soapstone used was replaced by a soapstone that weighed 70 per cent. more per cubic foot. In the third experiment, the same concentration of Paris green was used, but the flight was made at an altitude of 75 ft. and the dust was distributed at the rate of about 0.8 lb. Paris green per acre. This dusting was almost completely effective except in the densely overgrown area and demonstrated the feasibility of dusting at higher altitudes. It is concluded that aeroplane dusting for control of Anopheline larvae is a practicable and relatively economical procedure. Theoretically the release of more concentrated Paris green dusts at high altitudes should lower the cost of the dusting operations, but it seems difficult to place a dust cloud accurately at an altitude greater than 30 ft. The necessity for further investigations on some points is emphasised.

Herman (C. M.). Mosquito Transmission of Avian Malaria Parasites (Plasmodium circumflexum and P. cathemerium).—Amer. J. Hyg. 27 no. 2 pp. 345-350, 7 refs. Baltimore, Md, March 1938.

The following is taken largely from the author's summary: Experiments are reported in which attempts were made to transmit Plasmodium circumflexum and P. cathemerium, both isolated from red-wing blackbirds (Agelaius p. phoeniceus) and cowbirds (Molothrus a. ater), from infected to healthy canaries by means of Culex pipiens, L., C. apicalis, Adams, Aëdes sollicitans, Wlk., A. canadensis, Theo., A. cantator, Coq., A. vexans, Mg., and Theobaldia melanura, Coq. The only positive results obtained were transmission by T. melanura of both strains of P. circumflexum and by C. pipiens and A. sollicitans of both strains of P. cathemerium. It is suggested that the strains of P. cathemerium may be one or more new varieties, since in Huff's experiments [R.A.E., B 16 61] A. sollicitans failed to transmit a strain obtained from the English sparrow [Passer domesticus]. At least one female of C. apicalis, which has hitherto been recorded as feeding only on cold-blooded animals, engorged on the blood of a canary.

BOURGUIGNON (G. C.). Notes épidémiologiques sur la trypanosomiase humaine dans le sud-est du Congo Belge.—Bull. méd. Katanga 14 no. 1 pp. 1-36, 24 refs. Elisabethville, March 1937. [Recd. April 1938.]

The author records a series of observations on sleeping sickness made during the course of two expeditions in the Province of Elisabethville

(previously Katanga) in 1935 and 1936. The main object of the first tour was to collect strains of Trypanosoma gambiense from man; 24 out of the 29 strains infected the guineapigs or monkeys (Cercopithecus) into which they were inoculated. The maximum number of positive inoculations was made in a locality that was the most active sleeping-sickness focus. Moreover, a number of the strains established mechanically in guineapigs, or in guineapigs after passage through monkeys, proved to be readily transmissible by Glossina. Thus the danger of mechanical transmission by blood-sucking insects is not negligible and may be the origin of certain reservoirs of the trypanosome. Numerous trypanosomes were found in the blood of an infant less than 2 months old, and it was presumed to have been infected from its mother by means of flies other than Glossina. The monkeys inoculated were local ones, and each one showed an extraordinary number of trypanosomes in the blood. This "blood tropism" was also observed in man, and obviously favours the sudden outbreaks of the disease that have occurred in these regions. The strains collected differed from those of Leopoldville or Mayumba studied in 1933, which only infected guineapigs once in ten inoculations and, once passed through a guineapig, were no longer cyclically transmissible. T. simiae, which is very pathogenic to pigs, also shows a very marked blood tropism and, unlike T. congolense, is found swarming in the blood of pigs kept in numbers in kraals, etc.; this fact apparently explains the rapid and fatal nature of outbreaks due to this trypanosome, for an infection once introduced into a herd by Glossina is quickly spread mechanically by blood-sucking flies (Stomoxys and Haematopota), which are generally abundant [cf. R.A.E., B 23 185]. Moreover, it is probable that mechanical transmission augments the blood tropism of strains; such a phenomenon was clearly demonstrated in the collected strains in the course of numerous mechanical passages through guineapigs. The two or three trypanolytic crises usually noted in infections with strains of T. gambiense (during which the trypanosomes in the blood become very rare for several days) were not observed Thus the biological characteristics presented by them in these strains. indicate a constant danger of a sudden outbreak of the disease.

The factor that appears most likely to be connected with the high virulence of the strains is the simultaneous presence of different species of Glossina all able to transmit T. gambiense. Maclean, in a paper already noticed [23 295], suggested that T. gambiense may be transformed into T. rhodesiense by a change of vectors, and the author considers that there are strains possessing intermediate characters, and that they exist in regions where the tsetse-fly population is mixed. At Bukama, which is one of the oldest sleeping sickness foci in the Belgian Congo and one of the localities where game is most abundant, G. palpalis, R.-D., G. morsitans, Westw. G. pallidipes, Aust., and G. longipalpis, Wied., are all found. In a preliminary survey, G. palpalis represented only 4 per cent. of the tsetse flies. Cases showing symptoms resembling those of infection with T. rhodesiense have been observed in this area, and a strain was obtained that showed the characters of this trypanosome, was resistant to 1 gm. tryponarsyl per kg. bodyweight of the guineapig, and was transmissible by G. palpalis even after mechanical passage through a guineapig. This strain is quite possibly derived from T. gambiense, the local strains of which resemble T. rhodesiense in many particulars. Moreover, T. brucei has not been discovered in the game animals of the area.

The factors that are of importance in maintaining the endemicity of the disease in the regions surveyed are summarised: in addition to those already mentioned, they include arsenic resistance, which was observed in a number of the strains, the habits of the fishermen, who at certain times of the year live in temporary huts near Lake Tanganyika away from medical supervision in order to catch the fish ascending and descending the affluents, the movements of the population consequent on the economic development of the country, and the creation

of game reserves accessible to natives.

In 1936, an unsuccessful attempt was made to isolate *T. brucei* from game by finding fly belts with a high density of *G. morsitans* and inoculating the salivary glands of these flies into guineapigs. A number of observations were, however, made on the habits of *G. morsitans* on the high plateaux of the Kundelungu, where *G. palpalis* does not occur. The forests, which cover the slopes of the ravines, cease at an altitude of about 5,300–5,400 ft. and are replaced by grassland characteristic of the plateaux of the Province. *G. morsitans* was not found at altitudes higher than about 5,400 ft., but its distribution would appear to be determined by the vegetation rather than by altitude. In the dry season, it was taken during the day at points where frost occurred at night. At the foot of the Kundelungu, it is more abundant, although the game animals are less numerous, and it is suggested that the salt springs of this region attract it.

Murray (D. R. P.). Problems concerning the Efficiency of Oils as Mosquito Larvicides.—Part I. The Stability of Oil Films on the Surface of Water.—Bull. ent. Res. 29 pt. 1 pp. 11-35, 4 figs., 2 refs. London, March 1938.

In continuation of investigations on oils for use as mosquito larvicides [cf. R.A.E., B 24 241], the author has studied the stability of the

film in relation to the chemical composition of the oil.

The following is taken from his summary: Films of oil that at first cover the whole of an area of water frequently break up and leave the oil in patches and the rest of the surface uncovered. An investigation has revealed that this instability may be the result of certain relationships between the volatility of the aromatic and aliphatic hydrocarbons composing the oil mixture, or of the presence of certain polar

substances dissolved in the oil.

If the aromatic hydrocarbons are more volatile than the aliphatic, a tendency exists for the oil to become concentrated into one thick central lens, leaving the rest of the surface uncovered. If all the aromatics are more volatile than all the aliphatics, this action is very rapid and occurs whatever the proportion of the mixture. If the difference in the volatility is small, the phenomenon is only observed when the aromatics and aliphatics are present in approximately equal proportions. If the boiling range of the aromatics overlaps that of the aliphatics (as occurs when two oils containing both types of constituents are mixed), the phenomenon is much less clearly defined. Olefinic oils, e.g., oils obtained by cracking, behave like paraffinic oils in so far as lens formation is concerned. It is believed that these changes would not occur if the oil was extremely pure, since lenses are only stable if subject to lateral pressure from an invisible film of contaminating material.

Solutions of certain organic substances in oil tend to make unstable films on the surface of water; rupture of such a film (by wind or other agitation) allows a unimolecular film of the added substance to spread at the air-water interface. This forces back the oil film. The greater the agitation, the less the area of surface eventually covered by oil. In this class of substances are fats, fatty acids, naphthenic acid (a natural constituent of petroleum), some sulphonic acids and cholesterol. Certain other substances act in a contrary manner. They do not promote instability but actually counteract, and, if present in sufficient proportion, overcome, the instability produced by the first type of substance. The substances falling into this group are all at present of unknown composition, but include "cracked spirit gum" (a material derived by polymerisation of olefinic hydrocarbons), certain resins, and some substance present in petroleum and remaining in the residue after distillation. The last of these acts as a natural "stabiliser" and masks to some extent the instability phenomenon in commercial oils. It is found in largest quantities in the undistilled residues of aromatic concentrates. The quantitative relationship between the "stabiliser" and the substances promoting instability is not linear. Successive increments of the former equalise larger and larger amounts of the latter. Long-chain molecules, such as fatty acids, are the most difficult to stabilise; naphthenic acid is more easily counteracted, and cholesterol still more easily.

Thus, from the point of view of stability of the film, the oil should have a small aromatic content or a very high one; it should not contain 50 per cent. aromatics unless they are very high-boiling ones (e.g., of lubricating base fraction); it should consist of a mixture of wide and overlapping cuts of oil; and it should not contain fats or fatty acids added as spreaders. If spreaders are desired, resins should be employed.

LLOYD (H. M.). The Occurrence of Glossina morsitans in Tanganyika Territory in Vegetational Types other than Isoberlinia-Brachystegia Communities.—Bull. ent. Res. 29 pt. 1 pp. 77–98, 2 pls., 3 figs., 17 refs. London, March 1938.

An account is given of investigations carried out in August 1933 and September-October 1935 on the relation of *Glossina morsitans*, Westw., to the various plant communities that occur in small sections of Tanganyika Territory in which the community characterised by a predominance of *Isoberlinia* and *Brachystegia* is completely absent.

In one locality, where nine types of vegetation were recognised, Combretum fischeri savannah was favourable at all seasons, whereas open grassland, thin Protea savannah, dence hillside thicket strips, and swamps were definitely unfavourable at all seasons. In another locality, where seven types were recognised, open vegetation containing Ostryoderris stuhlmannii with scattered thickets occurring on eluvial soils and open vegetation containing Commiphora schimperi with scattered thickets occurring on alluvial soils were favourable, whereas dense thicket (Justicia and other genera), semi-dense thicket, seasonal swamp supporting Acacia drepanolobium and treeless seasonal swamp were unfavourable. G. morsitans living in the favourable types is

not dependent on the proximity of an *Isoberlinia-Brachystegia* community. It will not populate cultivated banana plantations in areas where favoured natural types of vegetation are present.

NEITZ (W. O.). The Transmission of Heartwater to and from Blesbuck (Damaliscus albifrons) by means of the Bont-tick (Amblyomma hebraeum).—Onderstepoort J. 9 no. 1 pp. 37-46, 3 figs., 4 refs. Pretoria, July 1937. [Recd. April 1938.]

Details are given of experiments carried out in South Africa during 1936–37 on the transmission of heartwater to blesbuck (Damaliscus albifrons) by means of Amblyomma hebraeum, Koch. Nymphs reared from larvae fed on an infected sheep transmitted the disease to a sheep and to two blesbuck, and nymphs and adults fed as larvae and nymphs, respectively, on one of the blesbuck transmitted the disease to sheep. Adults reared from the nymphs that had transmitted heartwater to this blesbuck also transmitted the disease to

a sheep.

A. hebraeum is widely distributed in the Union of South Africa and has been recorded from several different species of antelope and other wild animals. Since ticks that become infected as larvae retain their infection until the adult stage, it is believed that antelopes and possibly other wild animals are capable of spreading infected ticks over large areas. It is known that this tick may take more than two years to complete its life-cycle, and during this time several susceptible animals may be born, so that it is possible for the disease to be maintained in areas where there are no domestic animals. Heartwater has not yet been demonstrated in antelopes in nature.

Curson (H. H.) & Neitz (W. O.). The approximate Distribution of the Genus Glossina.—Onderstepoort J. 9 no. 1 pp. 101-104, 1 fldg map, 6 refs. Pretoria, July 1937. [Recd. April 1938.]

A map is given showing the approximate distribution of all the species collectively of the genus *Glossina* in Africa, compiled from data obtained from the various countries infested.

Kranefeld (F. C.) & van der Schaaf (A.). Een myiasis van de klauwen en hun omgeving bij runderen. [A Myiasis of the Hoofs and their Surroundings in Cattle.]—Ned.-Ind. Bl. Diergeneesk.
49 pt. 5-6 pp. 360-369, 4 pls. Batavia, 1937. (With Summaries in German and English.)

Myiasis in cattle due to the larvae of *Cordylobia* (*Booponus*) intonsa, Ald., has been observed in north Celebes since 1926; the skin bordering the hoofs is the part chiefly concerned. Descriptions are given of all stages of the fly and of the infestation, based on two papers already noticed [R.A.E., B 11 91], with notes on observations in Celebes, where so far only cattle have been involved. The condition often clears up spontaneously after the onset of the rains as a result of the muddy state of the ground [of. 11 92], and the natives put affected animals to graze in wet ground. In dry pastures, trenches are dug for the cattle to get mud on their legs. The treatment with tar used in the Philippines [loc. cit.] has been found effective in Celebes.

THOMSEN (L. C.). Aquatic Diptera. Part V. Ceratopogonidae.—

Mem. Cornell agric. Exp. Sta. no. 210 pp. 57-80, 9 pls., 16 refs.

Ithaca, N.Y., December 1937.

The material on which this study was based was collected largely in the vicinity of Ithaca, New York State. Generic and specific keys are given for the larvae and pupae and some of the eggs, with notes on the characters and habitats of some of the genera and species.

DORMAN (S. C.), HALE (W. C.) & HOSKINS (W. M.). The Laboratory Rearing of Flesh Flies and the Relations between Temperature, Diet and Egg Production.—J. econ. Ent. 31 no. 1 pp. 44-51, 27 refs. Menasha, Wis., February 1938.

Lucilia sericata, Mg., has been reared in large numbers without interruption for 8 years at the University of California, and in this paper a detailed account is given of the technique that has been evolved and of the information that has been obtained on the conditions

necessary for the production of fertile eggs.

The following is taken from the authors' summary: Fish heads provide cheap and satisfactory food for the larvae, and water, sugar and fish heads for the adults. Data are given on the effect of temperature on the duration of the various stages. Their development, and particularly that of the prepupal stage, can be retarded by chilling. The quantitative relation of temperature to the length of the pre-oviposition period has been studied. The developmental zero of egg formation, as determined by the extrapolation of the temperature-rate line, is about 14°C. [57·2°F.]. Carbohydrate is essential for continued life of the adult fly, and protein for the growth of the ovaries. Casein, sodium or ammonium caseinate, blood albumin, or a proprietary beef extract did not induce the development of ovaries. The eggs of old flies are more sensitive to sterilising agents, such as lysol, than those of young ones.

Mackie (D. B.). **Methyl Bromide—Its Expectancy as a Fumigant.**— *J. econ. Ent.* **31** no. 1 pp. 70–79, 7 refs. Menasha, Wis., February 1938,

In the course of this paper on the use of methyl bromide as a fumigant [cf. R.A.E., A 26.000], it is pointed out that it has proved entirely lethal to bed-bugs (Cimex lectularius, L.) in crew quarters on shipboard when applied at the rate of 1 lb. per 1,000 cu. ft. at atmospheric pressure with an exposure of 16 hours. Under conditions of vacuum fumigation, exposures of 90 minutes are lethal to the bugs, although death is delayed for several hours.

Bouhelier (R.) & Foury (A.). L'emploi du trichloréthylène pour la désinfection des grains.—Rev. Path. vég. 25 fasc. 1 pp. 5-25, 3 refs. Paris, 1938.

This article includes (pp. 23–25) a description of experiments on the effect on *Cimex lectularius*, L., and *Ctenocephalides* (*Ctenocephalus*) canis, Curt., of fumigation with trichlorethylene at the rate of 100 cc. per cu. m. [equivalent to 1 fl. oz. per 10 cu. ft.] at a temperature between 20 and 25°C. [68 and 77°F.]. All the insects were killed

by the shortest exposures to which they were subjected, viz, bugs in 18 hours, fleas in $19\frac{1}{2}$ hours, and colonies of bugs in a trunk tied up with paper and string in 23 hours.

WHITMAN (L.). The Multiplication of the Virus of Yellow Fever in Aëdes aegypti.—J. exp. Med. 66 no. 2 pp. 133-143, 7 refs. Baltimore, Md, August 1937.

The experiments described were undertaken to determine by titration whether the virus of yellow fever multiplies in Aëdes aegypti, L. [cf. R.A.E., B **22** 71; **23** 186]. Batches of approximately 200 females were fed on a monkey (Macacus rhesus) infected with yellow fever. At various intervals after the infecting feed, batches of 30 mosquitos were ground up and made up into suspensions of different dilutions, each of which was injected into the brains of 6 mice at the rate of 0.03 cc. per mouse. The titre of the sera from the monkeys on which the mosquitos had been fed and of the suspensions of mosquitos was taken to be the reciprocal of the dilution necessary to cause the death of 50 per cent. of the mice, this dilution being calculated mathematically from the percentage mortalities obtained with the known dilutions used.

The following is taken from author's conclusions: The Asibi strain of yellow fever virus multiplies within the body of A. aegypti. The content of virus falls for several days after the ingestion of infected blood, reaches a minimum during the first week, and then increases rapidly until quantities greater than those originally found can be demonstrated. The actual final amount of virus demonstrable,

however, is subject to variations of which little is known.

WHITMAN (L.) & ANTUNES (P. C. A.). Studies on Aëdes aegypti infected in the larval Stage with the Virus of Yellow Fever.—Proc. Soc. exp. Biol. Med. 37 no. 4 pp. 664-666, 1 ref. New York, January 1938.

Half-grown larvae of Aëdes aegypti, L., were placed in a mixture of blood serum from a monkey (Macacus rhesus) infected with yellow fever virus and an equal quantity of normal saline. Pupation occurred in 48 hours, and the pupae were transferred to tubes of clean water. Adults began to emerge on the fourth day after contact with the virus. The first 28 males were ground up and injected subcutaneously into a healthy monkey on the day of emergence. Four days later the monkey developed fever and had the virus in its blood. Infection did not result when 15 females 1–4 days old were allowed to feed on a healthy monkey, but 10 days later 29 females from the same batch produced it in another one by biting.

In further experiments, the larvae were not allowed to pupate in the serum solution, but were transferred to clean water. A suspension of the resulting males was titrated in mice [cf. preceding abstract], and the virus was found to be present, though the titre was low (284). This figure rose to 72,500 and 127,500 when similar batches of males

were tested 1 and 2 weeks, respectively, after emergence.

Adults resultant from larvae that hatched from eggs placed in the serum mixture and were washed and transferred to clean water on the day following hatching were shown, by titration in mice, to retain the virus if the original infection was unusually large. When newly

emerged infected males and females were allowed to pair and a suspension of the resultant adult offspring was injected into both mice and monkeys, no infection resulted.

DAMPF (A.). El Anopheles occidentalis Dyar & Knab (A. maculipennis auct.) en la Mesa Central de México. [A. occidentalis, D. & K. (A. maculipennis, auct.) in the Central Tableland of Mexico.]—
Rev. mex. Biol. 18 no. 3 pp. 91-122, 9 pls., 3 pp. refs. Mexico, D.F., 1936. [Recd. 1938.]

A full account is given of work in Mexico on the identity of the American form of Anopheles maculipennis, Mg., for which the author considers the correct name to be A. occidentalis, Dyar & Knab [cf. R.A.E., B 23 235]. In his view, the true A. maculipennis, with its subspecies messeae, Flni. (of which subspecies melanoon, Hackett, and fallax, Roubaud, are varieties) is palaearctic, whereas A. occidentalis, occurring in Canada, the United States and Mexico, with its two subspecies, labranchiae, Flni., in the Mediterranean regions of Europe and North Africa, and atroparvus, van Thiel, in Europe, is holarctic [cf. 23 152].

Roubaud's theory that A. maculipennis can be divided into biological races differing in feeding habits [16 210, etc.] is criticised, not only because his experiments were made with guineapigs [20 151, 212], which do not belong to the biocoenosis of this species, but also because it neglects morphology, which is the basis of modern taxonomy. The disappearance of malaria in some parts of Europe is attributed not to the formation of new races of A. maculipennis, but to changes in agricultural life that render man less, and animals more, accessible to

attack.

The morphology of the male hypopygia of the typical A. maculipennis, A. occidentalis and A. quadrimaculatus, Say, the female hypopygium of A. occidentalis and the eggs of these species and some of their varieties is discussed from observations of the author. The differences in hypopygia are considered of specific value [cf. 23 235].

It is considered that A. maculipennis aztecus, Hoffmann [23 193] does not differ in the characters of the male hypopygium from the Californian form of A. occidentalis, although the Mexican and Californian forms may be distinguished by the number of compartments

in the egg-floats.

In Mexico, A. occidentalis breeds in clean sunlit water with abundant vegetation. Captive females readily attack man. In the Valley of Mexico, larvae in all stages of development were found in winter. The temperatures were a little higher than in the Sacramento Valley, California, where no larvae or pupae are said to occur in winter.

Martini (E.). **Zur Frage der biologischen Arten.** [Regarding the Question of biological Species.]—*Arb. physiol. angew. Ent. Berl.* **5** no. 1 pp. 33–43. Berlin, 8th March 1938.

The author discusses the question whether the morphological characters recognised for the distinction of species of insects in systematic zoology are to be the sole standard accepted in classification in view of the occurrence, within species so defined, of forms that show important hereditary differences in biology. Nearly all the species considered are mosquitos, notably *Anopheles maculipennis*, Mg.

Bedia Bali. **Ueber** Aëdes caspius **Pall. in der Türkei.** [On A. caspius in Turkey.]—Arb. physiol. angew. Ent. Berl. **5** no. 1 pp. 44–49. Berlin, 8th March 1938.

Aëdes caspius, Pall., is one of the very variable species closely allied to A. dorsalis, Mg. The author records the results of examinations of the characters of larvae of this species collected in various parts of Turkey and of the adults reared from them. The water of some breeding places is described; it was turbid yellow, of normal taste and neutral in reaction. No larvae were found agreeing with the descriptions of A. dorsalis.

Swellengrebel (N. H.), de Buck (A.) & Kraan (H.). Mechanism of Malaria Transmission in the Province of North Holland.—J. Hyg. 38 no. 1 pp. 62–74, 3 figs., 3 refs. Cambridge, 1st January 1938.

An account is given of further investigations on the transmission of malaria in villages in North Holland [cf. R.A.E., B 24 283],

particularly the village of Uitgeest.

The following is taken largely from the authors' conclusions: Dissection of 37,407 females of A. maculipennis, Mg., race atroparvus, van Thiel, and 2,028 of race messeae, Flni., all taken in dwellings, showed the natural infection rate of the former to be 118 times as high as that of the latter. The periodicity of infection in race atroparvus is not associated with winter and is independent of temperature; it is the result of the annual occurrence, in the last three weeks of August as well as in autumn, of females that feed without maturing eggs. Infection can take place at least as late as 7th October, and at that time the parasites take no more than 3 weeks to reach the salivary glands. Winter affects the epidemiology of malaria in Holland by causing the sporozoites to degenerate. Anophelines transmit the malaria parasites from man to man and carry them from house to house in autumn, and man keeps them alive until the next transmission season and spreads them from village to village. In a house in which there are infected persons, a reduction in numbers of infected Anophelines in successive years or their disappearance may occur because the total numbers of Anophelines have been reduced by the removal of suitable sheltering places, or because the human carriers, although showing parasites in the blood, are no longer infective to mosquitos. The failure of infected Anophelines in a house to cause malaria in the inhabitants during the next year is due either to a partial immunity or to an unusually long period of incubation in the human host. The incidence of cases of malaria is highest in houses nearest the foci of Anopheline infection of the preceding year. The scattered cases (one-patient houses) do not all conform to this rule. distribution suggests that a certain number (less than one-fifth) of the malaria houses are infected by Anophelines carrying sporozoites during the period of their sexual activity in the second half of July and the first half of August.

Paul (W. R. C.) & Gomes (W. A.). The Paris Green Treatment of Paddy Fields in Anti-malarial Work.—Trop. Agriculturist 90 no. 2 pp. 88-90. Peradeniya, February 1938.

As complaints are periodically received in Ceylon that rice crops, particularly when in the ear, are damaged by the application of Paris

green for the control of Anopheline larvae, experiments were carried out to determine the effect on the yield of dusting with a mixture of 2 per cent. by weight of Paris green in powdered soapstone (the strength used in anti-malarial work). The first application was made on 21st May at the rate of 16 lb. per acre, the second on 4th June at $22\frac{1}{2}$ lb. per acre, and subsequent ones at weekly intervals until 23rd July at 20 lb. per acre, since this rate gave a high degree of control. On 3rd July, 50 per cent. of the crop was in flower. At no time during the period of growth of the crop was any adverse effect observed, and the yield from the two treated acres was slightly higher than the average obtained from 20 untreated acres cultivated under similar conditions [cf. R.A.E., B 26 37].

Jackson (R. B.). A Guide to the Identification of the Anopheline Larvae of the Colony of Hong Kong. With Notes concerning them.—Chin. med. J. 53 no. 3 pp. 259–270, 2 pls., 2 refs. Peking, March 1938.

Certain structures on the head, thorax and abdomen of Anopheline larvae, including those that are of value in identification, are briefly described. Notes are given on the collection, examination, preservation and mounting of larvae. The 10 species of *Anopheles* so far recorded from Hong Kong are shown in a list, their breeding places and their relation to malaria and filariasis are briefly discussed [cf. R.A.E., B 97; 26 125], and a key is given for the identification of their fourth-instar larvae.

CHI (Ta-chih) & Su (Der-long). Delousing in Refugee Camps.—Chin. med. J. 53 no. 3 pp. 271–277, 10 figs. Peking, March 1938.

An account is given of the methods used to keep the numbers of lice infesting refugees in Shanghai below the level at which they will transmit typhus and relapsing fever. Clothes infested with *Pediculus humanus*, L. (vestimenti, Nitzsch) are preferably treated by heat from charcoal stoves in a portable wooden chamber, the construction of which is given in detail. Alternatively, they are sprayed with a 2 per cent. solution of lysol and ironed, and the pockets, seams, collars, etc., are sprayed again with a mixture consisting of 2 parts cresol, 5 parts naphthalene and 93 parts crude oil. A mixture of 1 part cresol, 49 parts kerosene and 50 parts vinegar is used against *P. humanus capitis*, DeG.; adult lice die immediately on contact with the mixture, and the nits, loosened from the hair by the vinegar, are readily removed with a fine comb.

WHITMAN (L.) & ANTUNES (P. C. A.). The Transmission of two Strains of Jungle Yellow Fever Virus by Aëdes aegypti.—Amer. J. trop. Med. 18 no. 2 pp. 135–147, 11 refs. Baltimore, Md, March 1938.

Although evidence exists that jungle yellow fever [cf. R.A.E., B 24 34] has invaded towns and given rise to outbreaks transmitted by Aëdes aegypti, L., this has not occurred so often as might be expected, considering its widespread endemicity. It was thought possible that

the prolonged life of the jungle virus away from A. aegypti might have modified it to a point where it developed only with difficulty in this mosquito, and was therefore less readily transmitted by it. The experiments described were undertaken to investigate this possibility.

The following is taken from the authors' summary and conclusions: Two strains of jungle yellow fever, isolated in Brazil and Colombia, respectively, were transmitted to monkeys (Macacus rhesus) by the bites of A. aegypti under laboratory conditions. The Brazil strain has been carried through 17 mosquito-monkey-mosquito passages and the Colombia strain through four, and no difficulty has been encountered. The minimum extrinsic incubation period in the Brazil strain was about 14-15 days, or several days longer than in the Asibi strain, a virus of urban origin. It is suggested that the prolonged incubation period may play a part in limiting the importation of jungle virus into towns, since, with a lengthened period, the percentage of infected mosquitos that die before becoming infective is greater. Of 27 monkeys infected with the Brazil strain, 13 of 17 survivors either had no fever, or first showed fever after the virus had practically disappeared from the blood stream. In the 4 other survivors and in the 10 that succumbed, the onset of fever corresponded with the period of maximum circulation of the virus. It is suggested that the delayed febrile response in non-fatal cases may not be a characteristic of jungle yellow fever as such, but may be related to the pathogenicity for rhesus monkeys of the particular strain of virus used, whether of urban or jungle origin. If the response in man is comparable, many cases brought to town for treatment after the onset of fever would no longer be infective for the local examples of A. aegypti. This would also reduce the frequency with which the jungle virus could invade the urban centres.

BOYD (M. F.), CARR (H. P.) & ROZEBOOM (L. E.). On the Comparative Susceptibility of Certain Species of Nearctic and Neotropical Anophelines to certain Strains of P. vivax and P. falciparum from the same Regions.—Amer. J. trop. Med. 18 no. 2 pp. 157–168, 4 refs. Baltimore, Md, March 1938.

The experiments described were carried out, on the same lines as previous ones [R.A.E., B **24** 146, etc.], to test the comparative susceptibility of the Nearctic Anophelines, Anopheles quadrimaculatus, Say, and A. punctipennis, Say, and the Neotropical species, A. albimanus, Wied., to strains of Plasmodium vivax and P. falciparum from Florida and Cuba. A. albimanus was reared from eggs received in thermos flasks from Panama and Cuba, using the technique employed for A. quadrimaculatus [**23** 283], except that the water bath in which the pans of larvae rest was maintained at 80°F instead of 70. The Cuban strains of the two species of Plasmodium were proved to be immunologically distinct from the Florida strains.

From the results of this and previous experiments [24 111], it is concluded that the Nearctic Anophelines exhibit a high degree of susceptibility to infection with the two species of *Plasmodium*, whether derived from the Nearctic or Neotropical region. On the other hand, *A. albimanus* from Cuba and Panama shows a high degree of susceptibility to infection with the two species of *Plasmodium* from Cuba,

but is distinctly refractory to the Nearctic strains tested.

WOOD (F. D.) & WOOD (S. F.). On the Distribution of Trypanosoma cruzi Chagas in the southwestern United States.—Amer. J. trop. Med. 18 no. 2 pp. 207-212, 1 map, 3 refs. Baltimore, Md, March 1938.

During the summer of 1936, the faeces of 287 Triatomids (comprising $Eutriatoma\ uhleri$, Neiva, $Triatoma\ protracta$, Uhler, and a pale castaneous form that may be a variety of the latter) and the blood of 60 rodents, chiefly wood rats ($Neotoma\ spp.$), collected in Arizona, New Mexico, Texas and Utah, were examined microscopically for the presence of $Trypanosoma\ cruzi$ with negative results. All three forms of the bugs were successfully infected in the laboratory with a Brazilian strain of $T.\ cruzi$ by feeding on infected mice. The castaneous form was similarly infected with the Californian strain, which was not tested on the others. Although the two strains of $T.\ cruzi$ now known to occur in the United States [$cf.\ R.A.E.$, B 23 40; 24 206] are infective for animals, it cannot be concluded definitely that they are also infective for man.

PAPERS NOTICED BY TITLE ONLY.

- KING (W. V.) & McNeel (T. E.). Experiments with Paris Green [as a spray] and Calcium Arsenite as Larvicides for Culicine Mosquitoes.—J. econ. Ent. 31 no. 1 pp. 85–86, 2 refs. Menasha, Wis., February 1938. [Cf. R.A.E., B 26 112.]
- SHIELDS (S. E.) & LACKEY (J. B.). Conditions affecting Mosquito Breeding [in Alabama], with special Reference to Aëdes thibaulti Dyar and Knab (Diptera, Culicidae).—J. econ. Ent. 31 no. 1 pp. 95–102, 4 figs., 9 refs. Menasha, Wis., February 1938.
- LING (L. C.) & YAO (Y. T.). Morphological Variations and Abnormalities of the Larvae of A[nopheles] hyrcanus var. sinensis collected in Nanking Area.—Chin. med. J. Suppl. 2 pp. 539–543, 2 pls., 8 refs. Peking, March 1938.
- FENG (L. C.). The Tree Hole Species of Mosquitoes of Peiping, China [Aëdes chemulpoensis, Yam., A. seoulensis, Yam., A. niveus, Ludl., and A. peipingensis, sp. n.].—Chin. med. J. Suppl. 2 pp. 503-525, 5 pls., 10 refs. Peking, March 1938.
- Kubo (Michio). The Sexual Organs of Phthirus pubis Leach, 1815 with special Reference to the Copulatory Apparatus.—Chin. med. J. Suppl. 2 pp. 545-554, 3 pls., 6 refs. Peking, March 1938.
- Wagner (J.). Sur un cténopsyllide nouveau de Madagascar, Paractenopsyllus kerguisteli n. gen. et n. sp. [on rats and dogs].—Bull. Soc. Path. exot. 31 no. 3 pp. 224-228, 3 figs. Paris, 1938.
- Wetzel (R.). Insekten als Zwischenwirte von Bandwürmern der Hühnervögel. (Sammelreferat.) [Insects as intermediate Hosts of Cestodes of Fowls. A summary Review of the Literature.]—
 Z. hyg. Zool. SchädlBekämpf. 30 pt. 3 pp. 84-92, 42 refs. Berlin, March 1938.

YAO (Y. T.), Wu (C. C.) & Sun (C. J.). The Development of Microfilaria of Wuchereria bancrofti in Sandfly, Phlebotomus scrgenti var. mongolensis. A preliminary Report.—Chin. med. J. Suppl. 2 pp. 401–410, 2 pls., 9 refs. Peking, March 1938.

YAO (Y. T.) & Wu (C. C.). Notes on a Species of *Phlebotomus* newly found in Tsingkiangpu, North Kiangsu, China.—T.c. pp. 527-537,

4 pls., 13 refs.

Details are given of experiments carried out in North Kiangsu between 8th and 21st September 1936 to determine whether Filaria (Wuchereria) bancrofti could complete its development in Phlebotomus sergenti var. mongolensis, Sinton; some of the results have already been noticed [R.A.E., B 26 76]. Out of 59 laboratory-bred sandflies that fed on two cases of filariasis showing averages of 84 and 383 parasites per 20 cu. mm. blood, respectively, 37 became infected; 31, dissected from 8 hours to $4\frac{1}{2}$ days after feeding, harboured exsheathed microfilariae in the abdominal cavity or the thoracic muscles or both; 7, dissected from 8 hours to $10\frac{1}{2}$ days after feeding, harboured pre-sausage forms in the thoracic muscles, 3, dissected $3\frac{1}{2}-6\frac{1}{2}$ days after feeding, harboured sausage forms in the thoracic muscles, and 1, dissected $8\frac{1}{2}$ days after feeding, harboured a post-sausage form in the thoracic muscles. All the sandflies fed on the patient with the heavier infection died within $4\frac{1}{2}$ days, but 5 out of 76 of those fed on the patient with the lighter infection lived for $4\frac{1}{2}-12\frac{1}{2}$ days.

In the second paper, descriptions are given of both sexes of *Phlebotomus kiangsuensis*, sp. n., the unidentified species of sandfly found harbouring microfilariae of *F. bancrofti* in North Kiangsu [loc. cit.].

MENG (Ch'ing-hua) & WINFIELD (G. F.). Studies on the Control of Fecal-borne Diseases in North China. V. A preliminary Study of the Density, Species Make up, and Breeding Habits of the House-frequenting Fly Population of Tsinan, Shantung, China.—Chin. med. J. Suppl. 2 pp. 463-486, 3 graphs, 7 refs. Peking, March 1938.

This is the fifth of a series of papers reporting the results of studies on composting as a farm process in North China to control faecal-borne diseases and to increase fertilisers, and is a preliminary report of

studies on the flies frequenting houses in Tsinan.

The following is taken largely from the authors' summary: During August-December 1935, 31,370 flies were trapped at six stations in and near Tsinan, and 7,288 flies were bred from different types of faecal material. An analysis of the results showed that Chrysomyia megacephala, F., and Musca domestica vicina, Macq., are the most common flies in houses during the late summer and autumn, M. sorbens, Wied., being next in order of abundance. Muscina stabulans, Fall., Lucilia sericata, Mg., and flies of the genus Sarcophaga are also of some importance in houses. The flies probably reach their maximum numbers in August, after which they gradually become less abundant until they disappear in December. The individual species show a similar seasonal frequency, C. megacephala disappearing at the end of October, M. d. vicina in December, and the other species about the middle of November. The average densities of M. d. vicina and M. sorbens in the indoor stations were about twice as great as in the outdoor ones (in a farm courtyard and near garbage), whereas the average A (1479) Wt. P9/3656 1600 8/38 S.E.R. Ltd. Gp. 353. [B]

densities of C. megacephala and of the other species together in the outdoor stations were, respectively, $2\frac{1}{2}$ and 5 times as great as in the indoor ones. The average general fly density and the densities of both C. megacephala and M. d. vicina were twice as great in rural stations as in suburban ones; the densities of M. sorbens and of the other species were about equal in both. Human faeces seem to be the most favourable medium for the breeding of the two commonest house-frequenting species, all of the reared examples of C. megacephala and $92\cdot63$ per cent. of those of M. d. vicina being obtained from them. M. d. vicina can also breed in pig, cow and horse manure. Pig manure is the most favourable medium for the breeding of M. sorbens. The greatest variety of species was obtained from cow manure, but most of them were of no importance from the public health point of view.

Wang (Lo-shan). A comparative Study of the Oxygen Requirement of Mosquito Larvae.—Chin. med. J. Suppl. 2 pp. 487-493, 4 refs. Peking, March 1938.

Anopheline larvae feed chiefly at the surface of the water and remain there most of the time; larvae of Aëdes feed chiefly on débris at the bottom of their habitat and seldom rise to the surface for air; and larvae of Culex have habits that are intermediate. The experiments described were undertaken in Peiping with larvae of Anopheles hyrcanus var. sinensis, Wied., Aëdes japonicus var. koreicus, Edw., and Culex pipiens var. pallens, Coq., and occasionally with those of Aëdes albopictus, Skuse, to determine whether the different groups have different ways of absorbing oxygen (through the skin, anal gills, etc.) or whether they require different amounts of oxygen.

The results indicate that the absorption of oxygen dissolved in water is through the skin, and that the anal gills are of no importance in this respect, since their removal did not cause the larvae to rise more frequently to the surface nor did it shorten the life of larvae that were prevented from breathing free air. The amount of oxygen (either dissolved or free) required for survival was greatest in *Anopheles* and

least in Aëdes.

FENG (L. C.) & CHUNG (H. L.). The Effect of Temperature on the Development of Spirochaeta duttoni in Ornithodorus moubata.—
Chin. med. J. Suppl. 2 pp. 555-562, 4 refs. Peking, March 1938.

In continuation of previous work on the development of *Spirochaeta* duttoni in *Ornithodorus moubata*, Murr. [R.A.E., B **25** 24], experiments

were carried out to test the effect of low temperature.

A batch of young ticks fed on an infected rat was kept at $5-8^{\circ}$ C. [41–46·4°F.] for 130 days and then at $25-30^{\circ}$ C. [77–86°F.]. Single individuals from the batch were dissected each day during the first 16 days, each alternate day from the 17th to the 22nd day and about once a month from that time until the 99th day; and two were dissected after transfer to the higher temperatures, one on the 20th day and one on the 100th day. Living spirochaetes were found in the stomach contents up to the 63rd day, in the salivary glands on the 5th day, in the reservoir of the coxal glands on the 8th day, and in the nerve ganglia on the 2nd day. The legs and malpighian tubes were constantly negative. No spirochaetes were found in the ticks dissected

on the 81st or 99th day, or in those dissected after transfer to the higher temperatures. No infection resulted in mice inoculated with suspensions of the organs of ticks prepared on various dates between the 81st day at the low temperature and the 165th day after transfer to the higher temperature, or in mice on which ticks were fed on dates within this period. It thus appears that few spirochaetes penetrate the stomach wall of the tick at low temperatures, and that all die within 81 days.

In a second experiment, young infected ticks were kept for 2 months at 25–30°C., so as to ensure a well established infection, and were then transferred to a temperature of 5–8°C. Many living spirochaetes were present in the nerve ganglia, salivary glands and reservoirs of ticks dissected 17, 35 and 60 days later, but they were less numerous than in those dissected before transfer to the low temperature; they were absent from the stomach and malpighian tubes in all cases. Infection was transmitted by 15 ticks fed on a mouse 38 days after they had been transferred to the low temperature. The remaining ticks died before further dissections or feeding experiments could be carried out. The chief effect of low temperatures on spirochaetes in ticks seems to be a retardation of their movements and multiplication; they do not change the spirochaetes into granules that later develop into spirochaetes [cf. loc. cit.].

Further dissections of ticks from the lot continuously maintained at 25–30°C. [loc. cit.] at various intervals up to 197 days revealed living spirochaetes continuously present throughout the period. They were especially abundant in the reservoirs and nerve ganglia; although they were sometimes less numerous in the salivary glands, they were always present. Large numbers were also found in the genital organs. Spirochaetes in small numbers were found in the malpighian tubes of 8 out of 19 ticks in which they were examined, but invasion of these organs does not appear to be an essential part of the development in the tick. No spirochaetes were found in the stomach contents after

the 12th day [cf. loc. cit.].

Chung (H. L.) & Feng (L. C.). Studies on the Development of the Chinese Strain of Spirochaeta recurrentis in Cimex lectularius.—Chin. med. J. Suppl. 2 pp. 563-577, 9 refs. Peking, March 1938.

Details are given of experiments on the behaviour of the Chinese strain of *Spirochaeta recurrentis* in *Cimex lectularius*, L., fed on infected splenectomised squirrels [cf. R.A.E., B 25 98] and dissected after various intervals.

The following is largely taken from the authors' summary and conclusions: The gastric juice of the bugs appears to be unfavourable to the spirochaetes, for most of those ingested with an infected blood meal died within 24 hours, although a few occasionally survived in the stomach for 2 days. Spirochaetes were observed in the legs and coelomic cavity as early as $1\frac{1}{2}$ hours after the infecting meal, but in many cases they succumb there without multiplying or surviving for long periods. No spirochaetes were seen in the malpighian tubes or salivary glands, but one was found in the nerve ganglia. They do not go through an invisible evolutionary form in bed-bugs [cf. 18 223]. Splenectomised squirrels were not infected by the bites of infected bugs. The eggs and nymphs from infected bugs contained no spirochaetes and did not produce infection when inoculated into

splenectomised squirrels. On the other hand, spirochaetes were shown to survive and retain their virulence in the body cavity of a certain number of the bugs for at least 12 days after the infecting feed, so that the disease might occasionally be transmitted by crushing these insects.

Wu (C. C.) & Sun (C. J.). Notes on the Study of Kala-azar Transmission. Part III. Experimental Infection of Chinese Sandflies of the erect-haired Division fed on Kala-azar Patients and infected Chinese Hamsters.—Chin. med. J. Suppl. 2 pp. 579-591, 2 figs., 10 refs. Peking, March 1938.

An account is given of experiments carried out in North Kiangsu in 1936 in which laboratory-bred examples of Phlebotomus chinensis, Newst., P. sergenti var. mongolensis, Sinton, and P. kiangsuensis, Yao & Wu, were fed on kala-azar patients or on hamsters (Cricetulus griseus) infected with Leishmania donovani. The percentages of infection in the examples fed on the two hosts were, respectively, 19.26 and 56.25 for the first species, and 1.17 and 32.68 for the second. In the case of P. kiangsuensis, none of 4 on man and 1 of 28 on hamsters became infected, but the number used was too small for comparison with the other two species. Infection took place much more easily in P. chinensis than in P. sergenti var. mongolensis when both were fed on the same man or hamster. The flagellates were actively motile and well developed 4-6 days after the initial feeding. The flagellates in heavily infected mid-guts showed a much greater tendency to extend forward into the proventriculus than backward into the hind-gut. These facts are of importance from the point of view of transmission, because infected sandflies usually feed at intervals of about 21 days and by the time of the third feed, on the 6th day, their mouth-parts are usually infected.

CHOPRA (B. L.). Anti-malarial Measures in the Railway Area at Delhi.—Indian med. Gaz. 73 no. 3 pp. 150-151. Calcutta, March 1938.

The measures carried out against Anopheline larvae during 1936 included filling depressions liable to hold rain water, draining larger depressions containing water, connecting up rows of borrow pits or pools to form one large pit and treating the water collected with various larvicides, and stacking pieces of machinery, scrap iron, etc., in railway yards in such a way that no rain water could collect in them. After the onset of the monsoon, spraying against adult mosquitos in dwellings was carried out with satisfactory results, using a mixture consisting of 1 gal. pyrethrum extract (Pyrocide 20), 19 gals. kerosene and 1 gal. pine oil that has been used with success in huts in Zululand [cf. R.A.E., B 25 137].

ROBERTS (F. H. S.). Cattle Lice.—Qd agric. J. 49 pt. 2 pp. 115—120, 4 figs. Brisbane, 1st February 1938.

Lice are serious pests of cattle at times in most parts of Queensland, being most troublesome during the winter and spring when the pastures are dry and the animals are in poor condition. They lower the vitality of the infested animals, rendering them more susceptible to the effects of weather and disease. Brief notes are given on the morphology,

prevalence in Queensland and bionomics of the sucking lice, Haematopinus eurysternus, Nitzsch, H. tuberculatus, Burm., Linognathus vituli, L., and Solenopotes capillatus, End. [cf. R.A.E., B 24 88], and of the biting louse, Bovicola bovis, L. When only small numbers of cattle are concerned, lice may be effectively controlled by washing or spraying with nicotine sulphate diluted at the rate of 10 cc. to 2 gals. water (the amount required for an animal of average size). For treating larger numbers, dipping is recommended. The usual dip [cf. 19 37] used against the cattle tick [Boophilus annulatus microplus, Can.] is not very effective, but good results have been obtained when cresvlic acid is added to it, the formula for such a dip being 8 lb. arsenic, 5 lb. caustic soda, 1 gal. cresylic acid and 400 gals. water. The dip is prepared as for the cattle tick, but only 2 lb. caustic soda is used for every 8 lb. arsenic; 3 lb. caustic soda is then dissolved in 3 gals. water, 1 gal. cresylic acid is stirred in slowly, and the solution is added to 400 gals. of the prepared dip and agitated. If, however, the arsenic and soda dip is already in the tank, it is only necessary to add the cresylic acid solution prepared as described. Spraying and dipping have little effect on the eggs, and a second treatment is given after an interval of 14-16 days in order to kill lice that may have hatched since the first treatment. Dipping should be carried out during the autumn or early winter.

ROBERTS (F. H. S.). [Report of the Entomologist and Parasitologist, Animal Health Station, Yeerongpilly.]—Rep. Dep. Agric. Sth. Qd. 1936-37 pp. 141-142. Brisbane, 1937.

In the late winter of 1936 there was a serious outbreak among cattle in the Maranoa and adjoining districts of a disease that results from their eating the larvae of the sawfly, Platypsectra (Pterygophorus) interrupta, Klug. The problem is now recognised as being associated with a deficient diet [cf. R.A.E., B 20 83]. As in previous years, lice were very prevalent during the winter and spring of 1936 on cattle in the southern and central coastal areas. In all cases investigated, the species was Haematopinus eurysternus, Nitzsch. Promising results in control have been obtained with two dippings of the usual arsenic and soda dip to which cresylic acid has been added at the rate of 0.75 gals. per 400 gals. dip [cf. preceding paper]. In one locality puppies were heavily infested with the kangaroo louse, Heterodoxus longitarsus, Piaget.

McCulloch (R. N.) & Hockley (J.). Sheep Blowfly Control by Jetting. 1936-37 Experiment at Trangie Experiment Farm.—Agric. Gaz. N.S.W. 49 pt. 3 pp. 131-135, 2 figs., 1 ref. Sydney, 1st March 1938

During 1936–37, further experiments [cf. R.A.E., B 25 51] were carried out to compare the cost of treatment and returns in wool and lambs for flocks of Merino ewes protected from blowfly attack by crutching, jetting and hand dressing. In the autumn, drought prevented the application of treatments but only 14 strikes occurred in the whole flock. The treatments were carried out on groups of 300 sheep, each containing the same numbers of sheep of given ages and breech conformation. During the five months ending with the crutching of the entire flock on 23rd February, the first group was

jetted on 9th October, 10th November and 20th January with the calcium arsenite mixture (10:10:11:10) [cf. 22 17], the second was crutched on 12th October and a few strikes were hand-dressed during December-February, and the third was hand-dressed when necessary with boric acid in glycerine. Strike was abnormally light

during the spring and abnormally heavy during the summer.

The cost of the three jettings in labour and materials, if carried out with reasonable efficiency, is estimated to be approximately equal to that of one crutching, namely 1½d. per head or slightly more. The jetting was followed by an increase of more than 1¼d. per head in value of crutch wool for the first half of the season when compared with the other two types of treatment. It was impossible to determine whether jetting before and during mating had any significant influence on lambing, because of the large numbers of deaths among lambs due to malnutrition, but there was evidence indicating that it had no adverse effect on mating. The returns for wool at shearing showed no important differences between the groups, though that from the jetted sheep was very slightly higher. Damage caused by the drought completely obscured any effect that blowfly attack during the first half of the season may have had on the wool yield of the flock as a whole.

Entomological Investigations.—Rep. Coun. sci. industr. Res. Aust. 11 (1936–37) pp. 15–21. Canberra, 1937.

This report on the work carried out in Australia by the Division of Economic Entomology during 1936–37 includes a review of the progress of certain investigations in connection with the control of sheep blowflies [cf. R.A.E., B 25 246]. Further surveys of the distribution of these flies have shown that Lucilia cuprina, Wied., is widely distributed in western New South Wales, South Australia and Victoria, and that Calliphora nociva, Hardy, replaces the other species of Calliphora in the drier parts of Australia, and is second only to L. cuprina in importance as a sheep blowfly. Studies on the effect of different rates of desiccation on the growth of maggots in carcasses suggests that L. cuprina is more resistant to drying than the other species. If desiccation is so rapid that few or no maggots develop, the food materials in the carcass are preserved and again become available when the carcass is wetted; it would thus appear that, during a drought in the arid part of the country, there is a progressive accumulation of small carrion that becomes suitable for fly breeding as soon as rain falls. At Canberra many more larvae of L. cuprina developed in living sheep than in dead ones. It has been observed that only females with mature eggs are attracted to struck sheep, whereas fertilised and unfertilised females with developed or undeveloped eggs are equally attracted to carrion. It has been shown that the distribution of free water is very irregular in the fleeces of sheep wetted by rain, that the absorption of the water by the fleeces is slow, and that the suint portion takes up most of the moisture. A delicate dye test developed during a study of weathering of the fleece has revealed that weather (probably sunlight) oxidises the wax, which loses its protective qualities and exposes part of the fibre to damage. Search for a more efficient bait for blowflies has been continued, but none has been found more practically useful than carrion treated with sodium further observations confirmed the finding that baits treated with calcium sulphide attract more flies, but the difference

does not appear sufficient to justify the extra cost. Treating baits with powdered borax does not impair their attractiveness and prevents the escape of maggots from the traps by inhibiting their growth.

Wells (R. W.) & Knipling (E. F.). A Report of some recent Studies on Species of Gasterophilus occurring in Horses in the United States.—Iowa St. Coll. J. Sci. 12 no. 2 pp. 181–203, 17 figs., 12 refs. Ames, Iowa, January 1938.

This account of the bionomics of Gastrophilus nasalis, L., G. intestinalis, DeG., and G. haemorrhoidalis, L., which, together with G. inermis, Brauer, are the bot-flies that infest horses in the United States *cf. R.A.E., B 6 150; 23 169], includes the results of extensive studies made chiefly at Ames, Iowa, during 1932–35. Keys are given to the adults and the larvae of the second and third instars of the four species.

Maturing larvae of G. nasalis began to leave the host in the early part of May, adults were active as early as 31st May and eggs were found a week later. Maturing larvae collected from slaughtered horses on 26th August pupated readily, and adults emerged a few weeks later. Oviposition was observed as late as 7th November. Pairing does not occur readily in captivity and was not observed near horses in the open. The average number of eggs in 8 reared females was 465. The incubation period in early June was as short as 118 hours. The eggs are deposited on the hairs of the intermaxillary region, and hatching appears to be independent of external moisture, pressure or friction. Further observations and experiments have confirmed the conclusion of Wells [20 56] that the larvae, which are able to crawl readily on dry surfaces and are relatively resistant to desiccation, make their way through the hair close to the skin downward toward the lips, between which they make their way actively into the mouth. The action was shown to be geotropic. Examination of the buccal tissues of horses at intervals of from 1 to 38 days after newly hatched larvae were placed in the mouth failed to reveal larvae, but second-instar larvae of different sizes were recovered from the duodenum, and it is concluded that, if the larvae pass to this organ promptly after the first moult, the first instar occupies 17-19 days. The durations of the second and third instars have not been determined, but the total larval period is estimated to occupy 11 months. During May and June, the average prepupal period was 18 hours, and the pupal period ranged from a minimum of 16 days at room temperature to 20-21 days out of doors. At the end of August, it lasted from 33 to 64 days out of doors. It seems probable that larvae leaving the host later than August do not give rise to adults, nor do the pupae survive the winter.

G. intestinalis has been popularly regarded as the most abundant species in Illinois and Iowa, but its larvae were found to be less abundant in horses than those of G. nasalis. Adult activity was first observed towards the end of June, increased in August and reached its peak in September; it ceased about the first week in November. Adults emerged from pupal cases when the air temperature was as low as 55°F. and were able to fly at 60°F., but oviposition was not apparently attempted at this temperature. Pairing took place in small receptacles in captivity, but occurred more readily in larger spaces where flight was possible. Females reared and fertilised in captivity oviposited readily on the legs of a horse in a large

screen cage, some of them beginning within an hour of emergence. Oviposition occurs during flight; in no case was a fly observed to alight on a horse. The eggs are usually most numerous on the inside of the front legs between the knees and the hoofs; in September and October many may be laid on the region behind the elbow, on the flanks and on the mane. The average number of eggs found in 7 reared gravid females dissected was 861. In July eggs matured in 5 days; incubation is greatly delayed by cool weather. Observations were made on the length of life of the fully developed (latent) larva within the egg-shell, since it is in this state that it must await contact with the horse's lips in order to enter the mouth. Such larvae continue to infest horses in the autumn long after flies have ceased to oviposit. Larvae within the egg-shell died sooner at room temperature than under cooler conditions. The percentages of living larvae in eggs examined between the middle of October and the middle of February decreased from 48.9 to 0, the last living ones being found on 9th February. The warmth of the lips of the horse stimulates hatching [cf. 24 61], the pressure and friction seem to aid in the convection of the heat, and the moisture helps the larvae to leave the shell and prevents desiccation. The habits of the first-instar larvae are discussed from the authors' own observations and those of others [20 135; **23** 105]; it is concluded that the larvae occupy the tongue for 24-28 days. Only second-instar larvae have been found attached to the pharynx or epiglottis, and only second-instar larvae were found in the stomach nine weeks after newly hatched larvae had been placed in the mouth. Examination of tongues of horses in December and January lead to the conclusion that, since only a negligible number were found after 15th January, few enter the host after 15th December. The warm water method for destroying fully developed larvae within the egg [24 62] is briefly reviewed. Experiments showed that a tar oil distilled from the tars derived from the destructive distillation of cellulose waste (maize cobs) gave satisfactory results against both fully developed and developing larvae within the egg when liberally applied to the infested parts of the horse with a swab, but being oily and dark it gives the coat an unpleasant appearance, it persists for several days and collects dust. Phenol and cresol washes were ineffective against latent larvae at concentrations tolerated by the skin of the horse, and cannot, therefore, be recommended as ovicides.

Larvae of G. haemorrhoidalis leave the host about the first week in May, and adults were first observed at the beginning of June. Pairing took place in captivity but not so readily as in the case of G. intestinalis. Oviposition began shortly afterwards, in one instance in 55 minutes. The average number of eggs in 8 reared females was 160.3. They are attached to the base of hairs on the lips of the horse. The incubation period was about two days. After this and at favourable temperatures. moisture is the only stimulus needed for hatching; friction does not appear to be essential and, in the presence of free water, a change of temperature is not necessary; only 1 out of more than 100 eggs hatched in the absence of free water. Eggs removed from the host immediately after deposition survived for four days but not for six. The larvae were found to penetrate the epidermis of the lips and migrate in this tissue into the mouth. They apparently remain in the lips more than six days and probably cause great discomfort to the horse. The second-instar larvae were not found in the rectum of horses examined in December, and it is probable that they are in the stomach and duodenum, where they are subject to treatment by fumigation, throughout the winter. Most of the larvae removed from the anus of a horse pupated within 24 hours; the pupal period at room temperature is sometimes as short as 15 days.

Descriptions are given of methods for collecting the eggs of *G. nasalis* and *G. haemorrhoidalis* for experimental purposes, in which traps made of horse hide with the hair on are attached to the muzzles of horses.

JELLISON (W. L.) & KOHLS (G. M.). Tick-host Anemia: a secondary Anemia induced by Dermacentor andersoni Stiles.—J. Parasit. 24 no. 2 pp. 143–154, 7 refs. Lancaster, Pa, April 1938.

In the experiments described, anaemia was repeatedly produced in rabbits by heavy infestation of ticks, *Dermacentor venustus*, Banks (andersoni, Stiles). This condition is non-infectious and is due primarily to exsanguination by the rapidly engorging female ticks. It appears comparable to the anaemia observed in domestic stock and game animals infested by ticks in various parts of the world; it may be the immediate cause of death.

GLASER (R. W.). A Method for the Sterile Culture of Houseflies.—

J. Parasit. 24 no. 2 pp. 177-179, 1 ref. Lancaster, Pa, April 1938.

A satisfactory technique that has been evolved for the sterile culture of *Musca domestica*, L., is described, details being given of the methods used for sterilising the eggs, preparing the larval medium and the breeding receptacle, and introducing the eggs into the breeding receptacle.

Hutson (L. R.). Some Observations on Manson's Eyeworm of Poultry in Antigua, B.W.I., and a suggested Method of Control.—Trop. Agriculture 15 no. 3 pp. 66-68, 2 refs. Trinidad, March 1938.

In Antigua, both turkeys and fowls are infested by Oxyspirura mansoni, of which the insect host is the cockroach, Pycnoscelus surinamensis, L. [cf. R.A.E., B 19 100]. The experiments described were undertaken to determine the effect on infestation of the removal from the eyes of fowls of the nictitating membrane, which is the normal habitat of the parasite. The worms used for the experimental infestation of the fowls were obtained from cockroaches collected near poultry houses in several areas where infestation was known to be established; both adults and nymphs were found to be heavily infested. Larval worms were placed in the eyes of the fowls, or worm larvae, cysts or infested cockroaches were fed to them, and examination of the eyes was begun on the following day. No larvae were found in the three birds from which the membrane had been removed, whereas all three untreated birds became infested.

GHIDINI (G. M.). Le Glossine dell'Africa orientale italiana. [The Glossina of Italian East Africa.]—Riv. Biol. colon. 1 pp. 53-71, 6 figs., 15 refs. Rome, February 1938. (With Summaries in French, English, German.)

A general account, based partly on the literature and partly on recent observations, is given of the distribution in Italian East Africa

of the six species of Glossina that occur there, viz., G. longipennis, Corti, G. brevipalpis, Newst., G. palpalis fuscipes, Newst., G. austeni, Newst., G. pallidipes, Aust., and G. morsitans, Westw. Descriptions of each of these species and a key to them are included.

HEARLE (E.). The Ticks of British Columbia.—Sci. Agric. 18 no. 7 pp. 341-354, 28 refs. Ottawa, March 1938.

Lists are given of the ticks known or thought to occur in British Columbia and of the hosts with the species of ticks that have been recorded from them, as well as brief notes on the distribution, abundance and hosts of the various species and on the relation of some of them to Rocky Mountain spotted fever, tick paralysis, relapsing fever and tularaemia. In 1936, two cases of Rocky Mountain spotted fever occurred in British Columbia and two in Alberta.

Brumpt (E.). Identification des piroplasmes du chien du type Piroplasma canis. Transmission de la souche française par la tique sud-africaine Haemaphysalis leachi. Faible valeur des épreuves d'immunité croisée dans les piroplasmoses.—Ann. Parasit. hum. comp. 16 no. 2 pp. 97-116, 31 refs. Paris, 1st March 1938.

The author reviews work by himself and others on strains of *Piroplasma canis*, their identity, their ability to produce immunity in the host animal, and the possibilities of their being transmitted by various stages of different species of ticks, and gives details of some of his recent experiments having a bearing on these subjects. Adults of *Haemaphysalis leachi*, Aud., that had been fed as nymphs on dogs infected with a strain of *P. gibsoni* from China and a strain of *P. canis* from the environs of Paris, transmitted the latter but not the former. The French strain was not transmitted by adults that were the offspring of females fed on an infected dog [cf. R.A.E., B **8** 41, 67]. The intervening larval and nymphal stages had been fed on hedgehogs. All stages of development of *P. canis* were observed in a female of *Rhipicephalus sanguineus*, Latr. [cf. **25** 207].

Travassos (J.). Etudes expérimentales sur la transmission du "typhus exanthématique de Sao Paulo" par l'Amblyomma striatum Koch, 1844.—C. R. Soc. Biol. 127 no. 5 pp. 462–464, 6 refs. Paris, 1938.

Amblyomma striatum, Koch, is the only tick that has as yet been found naturally infected with the exanthematic typhus of São Paulo, although at the time this fact was discovered, it was recorded as A. ovale, Koch [R.A.E., B 23 210] from which it is distinct [24 2]. In this paper are given the results of experiments on its ability to transmit the disease. Uninfected adults were fed for periods of from 4 hours to 6 days on infected guineapigs and 8-51 days later were allowed to bite healthy guineapigs or were made into suspensions, which were inoculated into them. In most cases, transmission experiments were carried out with a single tick. The disease was contracted and almost always transmitted by adults of both sexes; the ticks became heavily infected after a meal lasting only 4 hours and transmitted the disease 10 days later. Even the rare individuals that did not appear to have transmitted the infection to healthy guineapigs by

biting produced typical infections in others into which they were injected after maceration. Infection was also produced by injection of suspensions of larvae that had fed on infected rabbits and had not moulted in the normal time, and by the feeding of nymphs and adults derived from infected larvae. It was also produced in 2 out of 12 experiments in which batches of eggs from females that had fed on infected guineapigs were injected into normal ones.

Travassos (J.). Transmission expérimentale du "typhus exanthématique de Sao Paulo" par l'Amblyomma brasiliense Aragao, 1908.—C. R. Soc. Biol. 127 no. 13 pp. 1375–1376, 1 ref. Paris, 1938.

Amblyomma brasiliense, Aragão, is parasitic in all stages on peccaries (Tayassus spp.), capybara (Hydrochoerus capybara) and tapir (Tapirus americanus) in Brazil, and frequently attacks man. Nymphs fed on guineapigs infected with São Paulo typhus became infected and the virus persisted for as long as 34 days in those that did not moult in the normal time. Adults obtained from them transmitted the disease when fed on normal rabbits and guineapigs.

Travassos (J.). La tique Amblyomma striatum Koch, 1844, comme vecteur du "typhus exanthématique de Sao Paulo." Infection naturelle en spécimens recueillis sur des chiens, dans un foyer de la capitale (Sao Paulo).—C. R. Soc. Biol. 127 no. 13 pp. 1377-1380, 1 ref. Paris, 1938.

Adults of both sexes of *Amblyomma striatum*, Koch, collected from dogs in São Paulo were fed on normal guineapigs or made into suspensions and inoculated into them. The results showed that the ticks were naturally infected with the virus of São Paulo typhus and could transmit it by biting. Details are given of two series of experiments in which positive results were obtained; in the first the infection was transmitted by the bite and subsequently by the inoculation of one out of 5 females and in the second by inoculation of a suspension made from 12 males and 1 female.

VIOLLE (H.) & SAUTET (J.). Transmission du typhus murin par un hémiptère brésilien (*Triatoma infestans*).—C. R. Soc. Biol. 127 no. 13 pp. 1276–1278, 2 refs. Paris, 1938.

A brief account is given of experiments in which nymphs and adults of *Triatoma infestans*, Klug, fed on rats infected with murine typhus were allowed to bite healthy rats or were made into suspensions and given to healthy rats as food. A first series gave doubtful results, but in a second series infection was produced when bugs were ingested 16 days after the infecting feed.

MORISHITA (K.). On some parasitological Interests in Formosa, with special References to Trypanosoma conorhini and Tsutsugamushi Disease.—Rev. med.-cirurg. Brasil (2) 46 no. 2 pp. 225-232. Rio de Janeiro, February 1938.

This address deals chiefly with recent work on the occurrence of Trypanosoma conorhini in Triatoma rubrofasciata, DeG. [cf. R.A.E., B

24 66]. This trypanosome was able to develop well in *Rhodnius prolixus*, Stål, from South America. Briefer notes are given on the epidemiology and aetiology of tsutsugamushi disease, transmitted by *Trombicula akamushi*, Brumpt.

Corson (J. F.). A third Note on the Infectivity to Man of a Strain of Trypanosoma rhodesiense: two further Passages through Antelopes and Tests on Volunteers.—J. trop. Med. Hyg. 41 no. 8 pp. 125–128, 10 refs. London, 16th April 1938.

In continuation of previous experiments with the strain of Trypanosoma rhodesiense isolated from man in October 1934 [cf. R.A.E., B 26 59], further cyclical passages to antelopes through Glossina morsitans, Westw., were carried out. Two flies that had fed on an eland failed to infect one native volunteer and one of them failed to infect another, both these men were however infected by flies that had fed on a reedbuck infected from the same dikdik as the eland. A European volunteer resisted infection by a fly from the same batch as one that had infected a native. The author puts forward various

suggestions that might explain these results.

He points out that it is difficult to answer the questions whether and when strains of T. rhodesiense that are maintained solely in animals, and particularly in ruminants, by passages through G. morsitans or in other natural ways, lose their infectivity to man. He briefly summarises Duke's experiments with strains of T. rhodesiense from Tanganyika Territory [cf. 25 133, etc.], and finds no evidence, from these experiments or from his own, that the infectivity of this trypanosome for man would be lost within a year or two when it was living only in animals and tsetse fly in nature; it has been shown that it can live in ruminant animals and G. morsitans for more than three years without losing its infectivity to man. He considers, however, that areas of game and tsetse fly with which man loses all contact for a year or two are of less practical importance as regards the question of animal reservoirs of human trypanosomes (though possibly of greater theoretical interest) than places where man does not lose contact for such long periods. Where man lives on the edge of fly belts or within lightly infested areas, domestic animals are kept and some of them are infected with trypanosomes.

GIBBINS (E. G.). The Mouth-parts of the Female in Simulium damnosum Theobald, with special Reference to the Transmission of Onchocerca volvulus Leuckart.—Ann. trop. Med. Parasit. 32 no. 1 pp. 9-20, 8 figs., 12 refs. Liverpool, 28th April 1938.

The following is the author's summary: The mandibles, maxillae, labrum-epipharynx, hypopharynx and labium of the female of Simulium damnosum, Theo., are described and figured in detail. It is suggested that the so-called "act of biting" is performed as follows: first, the mandibles, functioning as a pair of scissors, snip the skin; the maxillae are then thrust within the incision, which is enlarged by a tearing process until it is of sufficient size to allow the labrum-epipharynx and the hypopharynx to attain blood-level. The microfilariae of Onchocerca volvulus are liberated from the skin by the maxillae during the process of enlarging the initial incision. The numerous spines at the tip of the labrum-epipharynx form an

effective trap for wandering microfilariae. A detailed study of the labium has shown the extremely delicate nature of the inner surface of the labella, through which the *Onchocerca* find an easy exit.

GIBBINS (E. G.). Notes on Ethiopian Simuliidae. II.—Ann. trop. Med. Parasit. 32 no. 1 pp. 21–33, 20 refs. Liverpool, 28th April 1938.

This paper is based mainly on a study of the Ethiopian Simuliids in the collections at the British Museum and the South African Museum, Cape Town. The characters distinguishing five new species, S. barnardi and S. turneri from South Africa, and S. kauntzeum, S. taylori and S. bisnovem from Uganda, are described, and notes are given on the distribution and synonymy of other species. These include S. dentulosum, Roub. (gilvipes, Pom., ruwenzoriensis, Gibbins), S. medusaeformis, Pom. (pseudomedusaeformis, De Meillon), S. neavei, Roub. (vorax, Pom.), S. elgonensis, Gibbins (tisiphone, De Meillon), and S. cavum, n.n. (obscurum, Gibbins, nec. tristriyatum var. obscurum, Enderl.).

Southwell (T.) & Kirshner (A.). On the Transmission of Leishmaniasis.—Ann. trop. Med. Parasit. 32 no. 1 pp. 95-102, 30 refs. Liverpool, 28th April 1938.

The authors review the evidence relating to the transmission of the various forms of leishmaniasis and draw the following conclusions: It has not yet been proved that infections result from the inoculation of leptomonads by the bite of an infected *Phlebolomus*. In the sandfly, both leptomonad and leishmanioid forms occur in the mid-gut, and similar forms occur in cultures. The positive results obtained by inoculation of infected sandflies, and also of cultures, into man and animals may possibly be explained by the presence of these leishmanioid bodies both in the insects and in the cultures. It appears possible that transmission of leishmaniasis occurs as a result of infected sandflies being crushed on the skin, and that the infective stage is the leishmanioid body. Sufficient attention has not been directed towards infected nasal discharges as a method of transmission of kala-azar.

RICHARDS (H.). Rapport sur la désinsectisation des aéronefs à l'aérodrome de Khartoum.—Bull. Off. int. Hyg. publ. 30 no. 3 pp. 563-567. Paris, March 1938.

In this paper are given the results of inspections for the presence of insects, especially mosquitos, of commercial passenger-carrying aircraft landing at Khartoum between 2nd June 1934 and 2nd July 1937. Military and private aircraft are also inspected at this point, but in no case have mosquitos been reported from them. Except in rare instances, the aeroplanes, which come from all directions, have already been freed from insects at a port of entry into the Sudan. The procedure of inspection and spraying is briefly described; the mixture that has been used with completely satisfactory results since February 1936 consists of extract of pyrethrum, oil of citronella, carbon tetrachloride and kerosene, the respective percentages being 5-8, 2-0, 49 and 43-2. Of the aeroplanes inspected, 49, or little more than 3-5 per cent., harboured mosquitos. The 107 mosquitos,

most of which were found in dark corners or under the seats in the passenger cabins during the rainy season or just after, included 10 Anophelines; no species of Aëdes was taken. No mosquito has yet been taken in the new empire hydroplanes, which have been in use on the Khartoum service since April 1937.

CALDWELL (A. F.). A Note on the Chemistry and Preparation of Insect Sprays containing Pyrethrum.—J. Malaya Br. Brit. med. Ass. 1 no. 4 pp. 336–341, 16 refs. Singapore, March 1938.

The author points out that sprays containing pyrethrum extracts in kerosene, usually with the addition of some perfume, are considered the most satisfactory for use against mosquitos, and discusses, chiefly from the literature, the active principles of pyrethrum, the preparation of concentrated extracts for use as sprays after dilution with kerosene and of sprays by direct extraction with kerosene, the addition of perfumes, methods for determining the pyrethrin content of flowers, extracts or sprays, and the storage of flowers, powder, extracts and sprays.

MARTIAL (J. E.). Le paludisme à Lang Son.—Ann. Med. Pharm. colon. **35** no. 4 pp. 1132–1206, 15 refs. Paris, 1937.

In the first chapter of this paper on the problem of malaria and its control in the Province of Lang Son, Tonkin, the region is described and notes are given on its climate and population, the incidence of malaria in general, and the mosquito fauna, the information on the last subject being taken from the work of others [R.A.E., B 22 89]. The second and third chapters deal with malaria in the military and civil populations, respectively, and the fourth with the measures that are

being taken to combat the disease.

The numerous springs formed in the calcareous mountains of the region give rise to small streams of clear, unshaded water that are used to irrigate the rice-fields. They have a high "carbonic index" [cf. 22 31] and form favourable breeding places for Anopheles minimus, Theo., the chief vector, and A. jeyporiensis, James, a vector of secondary importance. In the delta, the rice-fields are cultivated all the year round, but in the higher areas there is only one crop a year and the fields, which remain fallow until the end of winter, offer excellent conditions for the breeding of A. minimus from October to January. The indigenous population, which has reached a state of premunition, acts as a reservoir of the malaria parasites, which cause serious outbreaks among the garrison troops and susceptible Annamese immigrants from the delta regions.

The anti-malaria measures include, in addition to the administration of quinine and the use of mosquito nets, the prevention of mosquito breeding in water storage receptacles in and around houses, the filling or draining of depressions, the embankment of rivers passing through settlements and the use of larvivorous fish. In the town of Lang Son, depressions have been filled with sweepings, domestic refuse and the branches and grass obtained when clearing vegetation; the decomposition of the abundant organic material immediately prevented the breeding of mosquitos, the hollows were gradually filled up at no cost

to the authorities, and no bad smells were given off.

Durand (P.), Giroud (P.), Larrive (E.), Mestrallet (A.) & Bouchet (L.). Etudes sur la maladie des porchers (Maladie de Bouchet).

Troisième mémoire.—Arch. Inst. Pasteur Tunis 27 no. 1 pp. 7-17. Paris, March 1938.

Clinical and epidemiological observations have shown that a disease from which swineherds suffer in France and Italy is derived from pigs. The possibility of its being transmitted by ticks or lice was considered, but the theory of tick transmission was rejected because ticks were absent from infected piggeries in Emilia. In this paper an account is given of unsuccessful attempts to transmit the disease to man by means of examples of *Haematopinus suis*, L., collected from pigs in localities in which the disease had occurred in man, or from abattoirs, in which case they were fed for 12–14 days on pigs that had received injections of blood from an infected man or pig. The lice were either allowed to feed on man or were made into a suspension that was placed in the eyes or on the scarified skin or inoculated subcutaneously.

Hadjinicolaou (J.). Observations on Anopheles marteri S. & P. (Diptera, Culicidae).—Riv. Malariol. 17 (1) fasc. 1 pp. 44-50, 2 figs., 7 refs. Rome, 1938.

Published records of the distribution and habits of *Anopheles marteri*, S. & P., are reviewed [R.A.E., B **21** 260, etc.]; it was observed in southern Bulgaria by Shannon in 1935. In July 1936, the authors found larvae of this Anopheline in a stream on Mount Itis, Central Greece, at an altitude of about 1,000 ft. They were abundant until early October and still occurred in November, disappearing with the advent of the heavy rains. The eggs were found in nature and are described for the first time. In the laboratory at water temperatures of 19–24°C. [66·2 to 75·2°F.], development from egg to adult was completed in 20 days.

No adults were found indoors in August, when they were observed in the open, but a few were taken in stables in autumn and winter and one in a bedroom in February. Under experimental conditions females could be induced to feed on man, but only with difficulty.

Bessler (C.). Sulla protezione meccanica antianofelica con particolare riguardo ai vari tipi di retine metalliche. [On Anti-mosquito Screening with special Reference to the various types of Metal Screens.]—Riv. Malariol. 17 (1) fasc. 1 pp. 51-61. Rome, 1938. (With a Summary in French.)

The author records the results of tests made in the Pontine marshes during 7 years with 19 different types of metal screens in order to ascertain their efficiency, durability and cost in practical use. The best results were given by steel, aluminium, Monel metal, bronze, and galvanised iron, but the first three were too costly for conditions in Italy, and screens of galvanized iron are not durable under coastal conditions. Screens of phosphor bronze, brass and copper require wire of sufficiently thick gauge, such as 0.3 mm., and the copper must be free from impurities. With wire of this thickness, a screen having 6 meshes per centimetre excludes Italian mosquitos.

YOELI (M.). Note on the experimental Infection of Anopheles elutus with Plasmodium falciparum by feeding through a prepared animal Membrane.—Riv. Malariol. 17 (1) fasc. 1 pp. 62-66. Rome, 1938. (With a Summary in Italian.)

The preparation of a thin membrane from a rabbit ear for the artificial feeding of Anophelines is described. The membrane was stretched over a tube filled with defibrinated blood containing gametocytes of *Plasmodium falciparum*, and *Anopheles sacharovi*, Favr. (clutus, Edw.) fed readily through it and became infected. The method should be useful for determining the infective power of blood, the receptivity of Anophelines, and the effect of drugs and sera on the gametocytes.

PAPERS NOTICED BY TITLE ONLY.

- Séguy (E.). Sur les caractères communs aux muscides et aux oestrides gastricoles.—Encycl. ent. B II Dipt. 9 pp. 1-21, 27 refs. Paris, 1938.
- GIL-COLLADO (J.). Répartition géographique des variétés d'Anopheles maculipennis en Espagne, avec de brèves considérations sur leur biologie.—Encycl. ent. B II Dipt. 9 pp. 157-170. Paris, 1938. [Translation: see R.A.E., B 25 290.]
- FARRÉRAS (E.). Contribution à l'étude de la ponte des Culex [C. pipiens, L.].—Ann. Parasit. hum. comp. 16 no. 2 pp. 146-150, 1 fig., 7 refs. Paris, 1st March 1938.
- BRUMPT (E.). Rickettsia intracellulaire stomacale (Rickettsia culicis n.sp.) de Culex fatigans.—Ann. Parasit. hum. comp. 16 no. 2 pp. 153-158, 2 figs., 20 refs. Paris, 1st March 1938.
- McCulloch (R. N.). Jetting for Blowfly Control. A Five-jet Nozzle.— Agric. Gaz. N.S.W. 49 pt. 3 p. 136. Sydney, 1st March 1938.
- Twinn (C. R.). Blackflies from Utah and Idaho, with Descriptions of new Species (Simulidae, Diptera).—Canad. Ent. 70 no. 3 pp. 48–55, 6 figs. Orillia, March 1938.
- PHILIP (C. B.) & PARKER (R. R.). Occurrence of Tularaemia in the Rabbit Tick (Haemaphysalis leporis-palustris) in Alaska.—Publ. Hlth Rep. 53 no. 15 pp. 574–575. Washington, D.C., 15th April 1938.
- EWING (H. E.). Two new Genera and one new Species of Siphonaptera. —Proc. ent. Soc. Wash. 40 no. 4 pp. 93-95. Washington, D.C., April 1938.
- DA COSTA LIMA (A.). Uma nova pulga do Mexico e nota sobre Hormo-psylla. [A new Flea (Myodopsylla diasi, sp. n., on a bat) from Mexico and a Note on Hormopsylla.]—Rev. med.-cirurg. Brasil (2) 46 no. 2 pp. 181-187, 6 figs. Rio de Janeiro, February 1938.
- Thompson (G. B.). The Parasites of British Birds and Mammals. XVIII. The Mammal Fleas and their Hosts.—Ent. mon. Mag. 74 no. 888 pp. 109-113. London, May 1938.

Marneffe (P.). **Notes sur le paludisme à Java.**—*Ann. Méd. Pharm. colon.* **35** no. 4 pp. 1335-1357, 3 maps. Paris, 1937. [Recd. April 1938.]

Overbeek (J. G.) & Stoker (W. J.). Malaria in Nederlandsch-Indië en hare bestrijding. [Malaria in the Netherlands Indies and its control.]—Meded. Dienst. Volksgezondh. Ned.-Ind. 27 no. 1-2 pp. 183-205, 3 pls., 1 map. Batavia, 1938.

Overbeek (J. G.) & Stoker (W. J.). Malaria in the Netherlands Indies and its Control.—J. Malaya Br. Brit. med. Ass. 1 no. 4 pp. 281–304, 18 pls., 1 fig., 2 maps, 2 fldg diagrs. Singapore, March 1938.

The information in the first paper on malaria and its control in Java was obtained in the course of a study tour undertaken in the summer of 1936 and is similar to that given in a paper by W. A. Nicholas [R.A.E., B 25 261–263], who also took part in the tour.

The third paper is a translation of the second, and in them the authors, under whose direction the tour was made, give an account of malaria and its control in the Netherlands Indies as a whole, but since more investigations have been carried out in Java than elsewhere, much of the information is similar to that in the other two papers. The Anophelines that occur in the Netherlands Indies are shown in a list, and notes are given on the biology, distribution and infection of those known to be vectors of malaria. Anopheles sundaicus, Rdnw., is widely distributed in the archipelago and is the most important vector. In Java and Sumatra, A. subpictus, Grassi, is far less important, but in south and west Celebes, where it often occurs in large numbers, it plays a significant part in the spread of the disease. A. aconitus, Dön., varies in importance; where it is constantly abundant it may be the cause of severe endemic malaria; high infection rates have been recorded in Java but it was not usually found infected in Sumatra even when its density was great. A. minimus, Theo., has been found infected in Celebes and A. m. flavirostris, Ludl., in West Java and on the island of Poeloe Laoet (Borneo). A. maculatus, Theo., which is one of the most dangerous vectors, has been found infected in Banka, Riouw and Middle Java. A. hyrcanus, Pall., is the most important vector in south Sumatra and has been found infected in Java and Borneo. A. kochi, Dön., is distributed over the entire archipelago and plays a part in the transmission of malaria when it is present in large numbers. A. leucosphyrus, Dön., has been found infected on the east coast of Sumatra and in east Borneo, and A. umbrosus in Banka, Sumatra and west Borneo. A. punctulatus, Dön., A. p. moluccensis, Sw. & Sw., which occurs more frequently than the typical form, and A. bancrofti, Giles, have been found infected in New Guinea.

BRUG (S. L.). Filaria bancrofti-overbrengers op Kabaena. [Vectors of F. bancrofti in Kabaena.]—Meded. Dienst Volksgezondh. Ned.-Ind. 27 no. 1-2 pp. 88-97, 3 diagr., 8 refs. Batavia, 1938. (With a Summary in English.)

Filaria bancrofti is common in the island of Kabaena, which lies south of Celebes, and its vectors were studied in the village of Dongkala on the eastern coast, where F. malayi was unlikely to occur.

Dissections were made of mosquitos that had bitten heavily infected patients. A distinction was drawn between mosquitos in which the microfilariae were developing normally (good vectors) and those in which they were almost unchanged after $2\frac{1}{2}$ days or more. This yielded a "crude" artificial infection index, including all mosquitos found positive on dissection, and a "corrected" index, for which all mosquitos with delayed development or no development were regarded as negative. The corrected indices are those given in this abstract.

Anopheles aconitus, Dön., had an infection index of 65 per cent., and of the two individuals that lived long enough for the larvae to mature. one had them in the thorax and the other in the head. Culex fuscocephalus, Theo., had an index of 75 per cent. Of six dissected after 145 days, two had mature larvae in the thorax, two had larvae in the proboscis and one had them elsewhere in the head. Furthermore, there were more larvae per mosquito than in any other species, including the Anophelines. Of the three examples of C. whitmorei, Giles, dissected, all were positive; the one dissected after 14½ days had larvae in the proboscis. Anopheles barbirostris, Wulp, and Culex fatigans, Wied., had infection indices of 29 and 27 per cent. larvae were found in the thorax and head of A. barbirostris after 10\frac{1}{2} and $12\frac{1}{2}$ days, and in the thorax and proboscis of C. fatigans after $10\frac{1}{2}$ days. Of three examples of C. annulirostris, Skuse, two were infected, one, dissected after 11½ days, having larvae in the proboscis. Of two examples of Anopheles maculatus, Theo., one was not infected, but the other had mature larvae in the thorax after 10½ days. Culex alis, Theo. and C. vishnui, Theo., often could not be distinguished after prolonged captivity and are therefore considered as one. Delayed development of the ingested microfilariae was the rule, but mature larvae were found after 11½ days in the thorax of two mosquitos and in the head of two, one of the latter having a proboscis infection. No development or only delayed development was observed in some other species of Anopheles and Culex and in various species of Aëdes.

The result of an investigation of the natural infection index was very poor, although 20 per cent. of the adult population of the village were infected with F. bancrofti. The index was 0 per cent. for A. barbirostris, 2 for A. aconitus, 0.5 for C. fatigans and 1.5 for C. alisvishnui. In all, 900 mosquitos were examined, but no mature larvae were found in them. One individual out of 37 of Anopheles hackeri, Edw., was infected, though 20 of this species that had bitten infected

persons had shown no infection.

RODENWALDT (E. R. K.). Die typischen geomorphologischen Situationen Niederländisch-Indiens in Bezug auf die Malaria. [The typical geomorphological Districts of the Netherlands Indies in Regard to Malaria.]—Meded. Dienst Volksgezondh. Ned.-Ind. 27 no. 1-2 pp. 98-109. Batavia, 1938.

Malaria control in the various parts of the Netherlands Indies requires not only a knowledge of the Anophelines and their biology, but also an analysis of the geology, configuration and other characters of the types of land and of the related biological conditions in which malaria occurs. In this paper, an account is given of the various types of land in the archipelago and of the ways in which they are modified by various factors.

Mertens (W. K.). Kan Triatoma rubrofasciata (De Geer) pest overbrengen? [Can T. rubrofasciata transmit Plague?]—Meded. Dienst Volksgezondh. Ned.-Ind. 27 no. 1-2 pp. 171-176. Batavia, 1938. (With a Summary in English.)

In view of the fact that *Triatoma rubrofasciata*, DeG., normally feeds on rats in Java [R.A.E., B **25** 164] and may sometimes bite man, the author investigated whether it was likely to transmit plague. Guineapigs subcutaneously injected with suspensions of bugs that had fed on infected guineapigs became infected and died of plague. The bugs retained the infection for at least a month, provided that they did not feed on healthy guineapigs, but did not transmit it to their eggs or the resulting nymphs. As starving bugs attack others of their own species, it is suggested that they might thereby acquire infection. Guineapigs were not infected by the bites of infected bugs, except in one of several instances in which the bite took place immediately after an interrupted meal on an infected animal. No plague bacilli were found in the excreta of infected bugs.

Bonne-Wepster (J.). Geographic Relationship of the non-Anopheline Mosquitos of New Guinea.—Meded. Dienst Volksgezondh. Ned.-Ind. 27 no. 1 pp. 206-212, 1 map, 1 fldg. table, 1 ref. Batavia, 1938.

Lists are given of the 121 mosquitos now known to occur in New Guinea, showing which of them have not been found elsewhere and which belong to the Australasian or Oriental faunas, together with records of the distribution within and outside New Guinea of all these species except the 17 Anophelines.

ELSBACH (E. M.). De broedplaatsen van A. barbirostris bancrofti aan den Boven-Digoel. [The Breeding Places of Anopheles bancrofti on the Upper Digoel.]—Geneesk. Tijdschr. Ned.-Ind. 78 pt. 10 pp. 506-519, 2 pls., 2 maps, 11 refs. Batavia, 8th March 1938.

The two vectors of malaria known to occur on the Upper Digoel, New Guinea, are Anopheles bancrofti, Giles, and A. punctulatus var. moluccensis, Sw. & Sw. A. bancrofti is the commoner and is three or four times as abundant at Tanah Merah, the only large settlement on the river, but, for several years, attempts to find its breeding place were unsuccessful. Recently, however, the larvae have been found in large numbers in a backwater, about 600 yards long and 200 yards wide, at a bend of the river about two miles from the settlement. Most of the bank is covered with Pandanus and is fringed by a wide belt of aquatic plants that produce the partial shade required by the larvae and have roots that sometimes reach down 23 ft. to the bottom of the clear, still water. Algae and water ferns grow between the plants.

Brug (S. L.). **Waarnemingen bij anophelinen.** [Observations on Anophelines.]—*Geneesk. Tijdschr. Ned.-Ind.* **78** pt. 10 pp. 520–523, 4 figs., 5 refs. Batavia, 8th March 1938. (With a Summary in English.)

Descriptions are given of aberrant females of Anopheles tessellatus, Theo., and A. vagus, Dön., and of both sexes of A. bancrofti var.

barbiventris, n., all taken at Kalawara, Celebes. Females of the new variety were caught in a cow-shed and adults of both sexes were reared from larvae found in sunny pools.

Brasier-Creagh (E. B.). Aerial War on the Mosquito. An Account of the Work undertaken by the Mosquito Patrol in India.—Pop. Flying 7 no. 2 pp. 70–73, 5 figs. London, May 1938.

This is a popular account of experiments already noticed [R.A.E., B 25 191] on the application of Paris green by aeroplane for the control of Anopheline larvae in the Delhi area, the author being the pilot who carried out the work. The aeroplane used was a DH 83 Fox Moth, and the dust was carried in a hopper placed inside the cabin and distributed through a venturi tube attached beneath the fuselage; the author suggests that future work would be done most satisfactorily by 2-engined monoplanes with hoppers and venturi tubes in the wings. The cost for treating large areas, provided that they are not very far from the aerodrome, may be 2-3s. per acre.

[VASIL'EV] WASSILIEFF (A.). La lutte antilarvaire, en Tunisie, doit-elle être saisonnière ou continue?—Arch. Inst. Pasteur Tunis 27 no. 1 pp. 31-41. Tunis, March 1938.

In the north and part of the centre of Tunisia, the water-courses are almost dry in summer, but contain a few small pools in which mosquitos breed; in winter they are flooded by the rains and the larvae are washed by the flood waters into ravines and drains beside the roads. At this season anti-larval measures in the water-courses may be suspended, sometimes for several months, but should be carried on in all places where the flood water persists for any length of time. Photographs taken from aeroplanes are of value in locating such water surfaces. In regions where the slopes are steeper, the water is not retained in the drains and the floods inundate low-lying land, forming permanent marshes and breeding places (for Anopheles algeriensis, Theo., and A. maculipennis, Mg.) into which a fresh supply of larvae is carried by each flood. Such marshes should be treated all the year round, except during periods of great heat when they dry out entirely. The establishment of Gambusia in lakes and water-courses is a very effective measure of control, but it is sometimes necessary periodically to remove dense masses of algae, accumulations of dead reeds, etc., that prevent the access of the fish to the larvae. In one such water-course, near Djemmel, were found large numbers of larvae of A. sergenti, Theo., as well as A. maculipennis. Numerous larvae of A. hispaniola, Theo., were found in a small pool full of filamentous algae at the edge of which were Gambusia, in spite of the fact that the water was rendered cloudy by soap left from the washing of clothes. In some oases, breeding places are permanent and breeding takes place all the year round; the almost complete absence of rainfall prevents the formation of new breeding places. Since these oases are in a stony desert miles from any other collection of water, no immigration of mosquitos takes place, and anti-larval measures should result in the complete eradication of Anophelines. It is suggested that the strict regulation of the use of the subterranean waters at Kébili and in the surrounding region would prevent the formation of artificial marshes and lead to the drying up of those already formed [cf. 25 252].

In oases where breeding takes place in permanent pools in the water-

courses, the filling or oiling of the pools is recommended.

Adult Anophelines were caught in large numbers in winter in native huts in the region of Sahel de Sousse; here the kitchens are separate from the living quarters. In other regions, cooking takes place in the living rooms and the mosquitos are repelled by the smoke. Large numbers of adults (A. maculipennis and A. hispaniola in one locality, and A. algeriensis in another) were also taken in huts during the summer at a time when larvae were absent from their usual breeding places, in the first case on account of the flooding of the water-course and in the other on account of the drying up of the marshes. Thus the absence of larvae does not always indicate the absence of mosquitos from a region. Advantage should be taken of the temporary absence of breeding places to destroy the adults in houses. It is concluded that biological observations should be made in each locality if the best results are to be obtained for the money expended.

CALLOT (J.) & RISTORCELLI (A.). Localité nouvelle pour Anopheles (Myzomyia) sergenti Theobald, 1907.—Arch. Inst. Pasteur Tunis 27 no. 1 pp. 105–107, 4 figs., 5 refs. Tunis, March 1938.

Anopheles sergenti, Theo., is recorded from an oasis near Kébili, in the Nefzaoua region of Tunisia. It is stated that the only other records of its presence in the Regency are from Tamerza by Langeron who described it under the name A. culicifacies, Giles [R.A.E., B 10 68] and from the Mogod country in the extreme north [but see preceding paper].

HUNDERTMARK (A.) & [preface by] MARTINI (E.). Ueber das Helligkeitsunterscheidungsvermögen von Anopheles maculipennis. [On the Capacity of A. maculipennis to differentiate various Intensities of Luminosity.]—Anz. Schädlingsk. 14 pt. 3 pp. 25– 30, 1 plan, 4 refs. Berlin, 15th March 1938.

The experiments described were carried out in Hamburg in 1937. In August at about 25°C. [77°F.], recently emerged unfed individuals of Anopheles maculipennis, Mg., race atroparvus, van Thiel, were placed in an annular flight chamber, glazed on the top to admit light and divided in eight equal intercommunicating compartments, one lined with white paper, two with light grey, two with medium grey, two with dark grey, and one with black. In one experiment, a given number of mosquitos was placed in each compartment at 11 a.m. and their distribution was ascertained at intervals of 15 minutes between noon and 2 p.m. During this "daylight" period, the different tints attracted the following average percentages: black 45.5, dark grey 10.8 and 14, medium grey 8.5 and 7.3, light grey 5.2 and 4.7, and white 4. In a similar test at nightfall, the average percentages were black 2.9, dark grey 3.7 and 2.2, medium grey 5.9 and 2.9, light grey 11.0 and 8.8, and white 62.5. Tests were then made by day and at nightfall in flight chambers with two compartments lined with papers close to each other in tint, and this proved that the young mosquitos were able to distinguish clearly between the various tints.

Identical reactions were observed in similar tests with newly emerged unfed examples of race messeae, Flni., but freshly engorged females of this race (captured about 24 hours previously in the evening

in a cow-shed) showed no marked preferences during the daylight period, though at nightfall they much preferred the light-coloured compartments to the dark ones. Further tests in September with the chamber with two compartments proved that engorged females of messeae were well able to distinguish the various tints, but were indifferent to them by day.

Recently emerged examples of atroparvus allowed to choose between two compartments of the same tint but of different humidities always strongly preferred the one with the greater humidity even if the difference was only 2 or 3 per cent. On the other hand, they strongly preferred a grey compartment with 74 per cent. humidity to a white one with 100 per cent. when tested by day at 22–23°C. [71·6–73–4°F.], the average percentages of the mosquitos in the two compartments being 83·1 and 16·9. The behaviour of recently engorged females of messeae was different, for about 83·5 per cent. chose a light grey compartment at 74 per cent. humidity in preference to a white one at 32 per cent.

[Enikolopov (S. K.).] Ehukononob (C. K.). Au sujet de l'écologie des Anopheles algeriensis Theo. [In Russian.]—Med. Parasit. 6 no. 3 pp. 354-359, 2 figs., 6 refs. Moscow, 1937. (With a Summary in French.)

Females of Anopheles algeriensis, Theo., were observed in considerable numbers in a village in the delta of the Sulak near Makhach-Kala in Daghestan [cf. R.A.E., B **18** 254], where favourable conditions for breeding occurred in large swamps formed by floods and fed by springs. They probably feed on wild animals, which are abundant, and attack man to such an extent that it is impossible to cultivate the otherwise suitable arable land amidst the swamps. The larvae were found in deep accumulations of clear fresh water with a summer temperature of $9-10^{\circ}$ C. [$48\cdot2-50^{\circ}$ F.]. These breeding places were densely covered with reeds, only slightly exposed to the sun and completely devoid of submerged aquatic vegetation. In winter, the larvae were observed in water that had a temperature of 4° C. [$39\cdot2^{\circ}$ F.], though that of the air was -11° C. [$12\cdot2^{\circ}$ F.]. In experiments in which larvae were exposed to frost for a week, during which time the water in the container froze to the bottom, they eventually revived when transferred to laboratory temperature, but did not pupate.

The adults appear at the end of April or beginning of May, and are abundant till the beginning of December. The females fly about in swarms and readily attack man and domestic animals at sunrise and sunset. During the day they feed only among the reeds and dense vegetation where they shelter. The males, which were scarce, also flew at sunrise and sunset and rested during the day on the reeds close to the surface of the water. Large numbers of females congregated during the day in inhabited houses near the swamps, but none occurred in villages at a distance of some 2 miles. This species is probably not an important vector of malaria, as only a few of the workmen engaged in the reclamation of the infested swamps suffered from it, whereas all those working in villages where A. maculipennis, Mg., was abundant did so. Notes are given on the morphology of the adult female, larva and pupa of A. algeriensis.

[Shirinov (A. Sh.).] Ширинов (A. Ш.). Expériences avec des larves d'Anopheles maculipennis Mgn. dans l'eau de la Mer Caspienne. [In Russian.]—Med. Parasit. 6 no. 3. pp. 360-362. Moscow, 1937.

Malaria is prevalent on the island of Sara and on a promontory in the Caspian Sea in the region of Lenkoran, although no accumulations of fresh water that would form typical breeding places of Anopheles maculipennis, Mg., which is common in the region, occur there. was considered unlikely that the Anophelines fly to the island from the mainland, investigations were made in 1936 on breeding A. maculipennis in sea water. Eggs of race maculipennis (typicus), which is the predominant local race, were placed in tanks filled with water taken about 200-300 yds. out from the sea-shore, of which the sodium chloride content was 4,570.9 mg. per litre, and the larvae that hatched from them were fed on ground dried liver. Of these, 40 per cent. in three tanks of which the salinity rose to 4,925 mg. at the end of the experiment and 24.4 per cent. in a fourth, in which it rose to 10,878 mg., gave rise to adults in the normal period of time. These results show that under the conditions prevailing in the south-western part of the Caspian Sea, A. maculipennis is able to breed in salt water in depressions on the shore in the absence of the usual fresh-water breeding places.

[Sergeeva (Z. D.).] Сергеева (3. Д.). Variétés d'Anopheles maculipennis dans la RSS de la Russie Blanche. [In Russian.]—Med. Parasit. 6 no. 3 pp. 363–365. Moscow, 1937.

The examination in 1935 and 1936 of 92 batches of eggs of Anopheles maculipennis, Mg., collected in 12 districts in the Republic of White Russia, showed that races maculipennis (typicus) and atroparvus, van Thiel, occurred in 6 districts, while race messeae, Flni., occurred in all. Notes are given on the places where they were taken, and the eggs of each race are briefly described. The relation between the lengths of the floats and eggs and the number of ribs on the floats are shown in tables. In addition, 4 eggs were found that had rough floats but no pattern and were completely covered with a silverish film. Of two engorged females taken in warm hibernation quarters in a cow-shed in the environs of Gomel in December, one was atroparvus.

[Derbeneva-Ukhova (V. P.).] **Дербенева-Ухова (В. П.). Die Oekologie der Larven von** Musca domestica unter natürlichen **Bedingungen.** [The Ecology of the Larvae of M. domestica under natural Conditions.] [In Russian.]—Med. Parasit. **6**no. 3 pp. 408–417, 1 graph, 12 refs. Moscow, 1937. (With a Summary in German.)

Investigations were made in and near Moscow in September 1935 and August 1936 on the temperature conditions under which larvae and pupae of *Musca domestica*, L., develop in large breeding places in nature. Examination of samples of kitchen refuse and different types of manure showed that three times as many larvae occurred in pig dung as in horse or cow dung or refuse [cf. R.A.E., B 24 44]. Observations on two different days on larvae and pupae in horse manure kept in a wooden box with a loosely fitting lid that allowed (1750) [5]

access to the manure, which was added to daily, showed that in the middle of the heap most of the larvae occurred just below the surface, where the temperature was 42 and 45°C. [107.6 and 113°F.]. larvae occurred at a depth of 6 ins. at 50 and 63°C. [122 and 145.4°F.], but pupae and a few mature larvae were present at a depth of 12 ins., where the temperature decreased to 35 and 44°C. [95 and 111·2°F.]; at a depth of 24 ins., pupae alone occurred. Measurement of the temperature of the manure laterally showed that the maximum was reached in the centre and that it was cooler near the walls of the box. It appears, therefore, that the larvae descended into the lower layers by first crawling towards the walls of the box and then making their way down, thus avoiding the high temperatures in the centre. The presence of the larvae in the upper layer depends mostly on the temperature and then on the freshness of the manure. In a heap of manure exposed at an air temperature of 11°C. [51.8°F.] only one larva was found in the upper layer, where the temperature was 16°C. [60.8°F.], the majority congregating at depths of 3, 6 and 12 ins., where the temperature was 23, 30 and 44°C. [73.4, 86 and 111.2°F.], respectively, though the manure there was old and fermentation in it had ceased.

It was found that the distribution of the larvae in a large exposed accumulation of horse manure also depends on the degree to which it is heated by the process of fermentation or cooled by the temperature of the air. At air temperatures above 20°C. [68°F.], the larvae concentrate in the upper 1-inch layer, in which the temperature ranges from 38 to 46°C. [100·4-114·8°F.]. If the air temperature drops, the upper layer of the manure becomes cooler and the larvae descend deeper. In pig dung, in which the process of fermentation is slower than in horse manure, the larvae develop at lower temperatures, ranging from 20 to 41°C. [68–105·8°F.]. Pupation often takes place in the manure at the base of the heaps, and invariably at temperatures lower than those at which the larvae occur. Under certain unfavourable conditions, such as prolonged rain, the larvae may pupate prematurely and the pupae are small. In horse manure to which fresh material was not added for 10 days and of which, consequently, the temperature at a depth of 6 ins. gradually fell from 41° to 29°C. [105.8 to 84.2°F.] the combined egg and larval stages and the pupal stage lasted 3-4 and 6 days, respectively.

[Pokrovskii (S. V.) & Sil'vers (I. L.).] Покровский (С. В.) и Сильверс (И. Л.). Observations sur les éléments de faune d'Aphaniptera se trouvant sur les rats des villes de Moscou, Toula, Riazan et Kalinine, d'après les observations faites en 1935. [In Russian.]—
Med. Parasit. 6 no. 3 pp. 418-423, 1 graph, 3 refs. Moscow, 1937. (With a Summary in French.)

In the course of a further rat-flea survey in Moscow [cf. R.A.E., B 24 68] carried out in the Zoological Gardens and the adjoining area, about 1,000 fleas, consisting mostly of Xenopsylla cheopis, Roths., and Ceratophyllus fasciatus, Bosc, with 2 examples each of Leptopsylla (Stenopsylla) segnis, Schön., and Pulex irritans, L., were collected from 136 rats. Of the 661 fleas found on rats in the Zoological Gardens, 495 were X. cheopis. Of fleas found on Mus (Rattus) norvegicus in the town of Kalinin, 8.7, 90.3 and 1 per cent., respectively, were X. cheopis, C. fasciatus and L. segnis, but 11 of 22 found on M. (R.)

rattus in Tula were X. cheopis. Of the 73 fleas taken in June on 32 examples of M. norvegicus in Ryazan, 68 were C. fasciatus and 5 L. segnis. Females of X. cheopis and C. fasciatus were much more numerous than males, probably owing to their greater longevity.

[PIVOVAROV (V. M.) & GUTERMAN (É. M.).] Пивоваров (В. М) и Гутерман (З. М.). L'emploi de l'anabadust dans la lutte contre les moustiques hibernants. [In Russian.]—Med. Parasit. 6 no. 3 pp. 424-432. Moscow, 1937. (With a Summary in French.)

In experiments in Voronezh, a dust of finely ground slaked lime impregnated with 5–10 per cent. anabasine sulphate was found effective against hibernating mosquitos, when applied at the rate of 5 oz. per 1,000 cu. ft. In the laboratory, at temperatures ranging from 4 to $-4^{\circ}\mathrm{C}$. [39·2–24·8°F.] and a humidity of 59–91 per cent., it gave 100 per cent. mortality of Culicines taken from hibernation quarters in four tests and 99·15 per cent. in another. Some of the mosquitos were not killed immediately [cf. R.A.E., B **25** 200], but died in the course of 2–3 days as a result of paralysis of the motor centres. When the dust was applied with a hand duster in cellars in which mosquitos were hibernating, it killed over 98 per cent. of Culex and 97·5 per cent. of Anopheles. As the dust acts only when in direct contact with a mosquito, it is essential for the carrier to be dry and for the apparatus to effect a good dispersion.

[SMOL'NIKOV (V. M.) & KONDRAT'EV (P. Ya.).] Смольников (В. М.) и Кондратьев (П. Я.). Appareil "SK." [In Russian.]—Med. Parasit. 6 no. 3 pp. 433–435, 4 figs. Moscow, 1937.

A description is given of a hand dusting apparatus, worked by a bellows and weighing only 2 lb., that was found effective for applying dust against mosquito larvae or adult mosquitos in buildings. It produces a dust cloud about 10 ft. long and 6 ft. wide.

[MASAĬTIS (A. I.).] Масайтис (A. И.). Hibernation of Mosquitoes in Orenburg City. (From Data of Work done in 1935–1936). [In Russian.]—Med. Parasit. 6 no. 3 p. 437. Moscow, 1937.

Of the mosquitos found in the winter of 1935–36 in 240 cellars and basements in the town of Orenburg, $2\cdot 1$ per cent. were Anopheles maculipennis, Mg., race messeae, Flni., and the rest were Culex pipiens, L. Most of the hibernation quarters of the former were near the outskirts of the town, probably owing to the proximity of permanent and temporary accumulations of water caused by floods. The temperature in the cellars and basements varied from 4 to -4° C. [39·2–24·8°F.]; at the end of February only half of them had a temperature below freezing point.

[Danil'chenko (—).] Данильченно (—). Work of Dusting from Aeroplane in the Province of Kiev in 1936.—[In Russian.]—Med. Parasit. 6 no. 3 p. 446. Moscow, 1937.

In 1936, breeding places of Anopheles maculipennis, Mg., covering a total area of some 183 sq. miles in the Province of Kiev were dusted from an aeroplane with Paris green at the rate of 2·8-4·3 oz. per acre, nine applications being made between 20th May and 26th September.

The results, which are tabulated, show that the percentage mortality of first-instar larvae ranged from 66.7 to 100 and that of the other instars from 75.1 to 100.

[IOFF (N. A.) & TRONENKOVA (N. A.).] Mode (H.A.) и Троненкова (H. A.). Die ökologische Abhängigkeit der Anopheles maculipennis Larve von der Saprobität der Gewässer. [The ecological Dependence of the Larva of A. maculipennis on the Pollution of the Water.] [In Russian.]—Med. Parasit. 6 no. 4 pp. 538-545, 7 refs. Moscow, 1937. (With a Summary in German.)

Investigations on the presence of larvae of Anopheles maculipennis, Mg., in various types of stagnant and running water in the town of Tula and its environs showed that pollution was the chief ecological factor that influenced their distribution, first- and second-instar larvae being especially susceptible to the effects of decaying organic matter. The presence of bacteria in the water is of primary importance, as the bacterial film covering the surface of motionless water protected from the wind apparently acts as a mechanical barrier that prevents young larvae from access to the atmospheric air, whereas older ones are able to penetrate it. Moreover, if the bacteria are abundant, their toxic products kill the larvae. Some accumulations of water in Tula are highly polluted and free from Anopheline larvae in summer, but become diluted with rain in spring and autumn, so that the larvae are able to develop.

[Danilova (M. I.) & Lappin (G. I.).] Данилова (М. И.) и Лаппин (Г. И.). A propos des espèces d'Anopheles et des variétés d'A. maculipennis dans la région Azov-Mer Noire. [In Russian.]—Med. Parasit. 6 no. 4 pp. 546-549, 10 refs. Moscow, 1937. (With a Summary in French.)

This is a survey, mostly from the literature, of the local distribution of Anophelines in the region of the Azov-Black Sea coast as far south as Adler in Transcaucasia [cf. R.A.E., B 25 198, etc.]. They comprise, in ascending order of importance as vectors of malaria: Anopheles plumbeus, Steph., which has been recorded from only three localities situated among dense forests of deciduous trees; A. claviger, Mg. (bifurcatus, auct.), which was scarce except in two localities; A. hyrcanus var. pseudopictus, Grassi, which was abundant in flooded estuaries of rivers overgrown with reeds; and A. maculipennis, Mg., of which race maculipennis (typicus) occurred in small numbers and in a few places only, and races messeae, Flni., and atroparvus, van Thiel, were abundant and widely distributed. Females of race atroparvus increased in numbers in inhabited houses towards the autumn and continued to feed periodically during the winter. This race has also been found in an arid district far from the Azov sea, where there are accumulations of brackish water.

[Kremer (B. I.) & Kuvichinskii (B. S.).] Кремер (Б. И.) и Кувичинский (Б. С.). Anabadust—nouvelle méthode pour la lutte contre les moustiques adultes. [In Russian.]—Med. Parasit. 6 no. 4 pp. 550–555. Moscow, 1937. (With a Summary in French.)

Details are given of laboratory and field tests in the Crimea on the effectiveness against mosquitos and sandflies (*Phlebotomus*) of dusts of

anabasine sulphate and finely ground slaked lime. The results of dusting against mosquitos in buildings in various localities at temperatures varying from 1 to 30°C. [33.8-86°F.] with dusts containing 10, 15 or 20 per cent. anabasine sulphate are given in a table; the stronger dusts gave 100 per cent. mortality in all tests and the weakest one did so in 4 tests out of 7. It is emphasised that the dust must come into contact with the body of the insects. In hot weather, the mosquitos were paralysed in 1-2 minutes, and eventually all died, though a few of those dusted with the lowest concentration survived until the following day. The rapidity of action of the dust increased with the temperature. Dusting at the rate of 1 oz. to 2,000 cu. ft. in inhabited houses and 1 oz. to 1,500 cu. ft. in animal quarters was found sufficient to destroy all the mosquitos, whereas 75 oz. of tobacco dust would be required to fumigate the same space. In tests in houses in Sebastopol, practically all sandflies were paralysed almost instantaneously by 10-15 per cent. concentrations of the dust, and died in 5-10 minutes.

[Kozhevnikova (S. M.).] Ножевникова (С. М.). Découverte de l'Anopheles bifurcatus L. dans les environs de Stalingrad. [In Russian.]—Med. Parasit. 6 no. 4 p. 574. Moscow, 1937.

In April 1937, third- and fourth-instar larvae of Anopheles claviger, Mg. (bifurcatus, auct.) were found near Stalingrad in an exposed accumulation of shallow water covering some 85 sq. ft. and fed by springs. The temperature of the water was 8°C. [$46\cdot4^{\circ}F$.]. This record considerably extends to the south the known distribution of A. claviger on the Volga.

[Kalita (S. R.).] Напита (C. P.). Quelques données sur les types d'oeufs des variétés d'Anopheles maculipennis de la partie méridionale de la région Azov - Mer Noire. [In Russian.]—Med. Parasit. 6 no. 4 pp. 574-577. Moscow, 1937.

Examination of a large number of eggs laid by females of Anopheles maculipennis, Mg., taken in three districts in the south-eastern part of the Azov-Black Sea Province showed that they belonged to races maculipennis (typicus), messeae, Flni., and atroparvus, van Thiel. The average numbers of eggs laid by females in different months are tabulated; fecundity decreased with the approach of the autumn, and the highest figure (279·5 eggs) was obtained in June for a female of race messeae. The morphological characters of the eggs of the three races are briefly discussed, and the measurements of their width and length, and the length of the floats and the number of ribs on them are given.

[Shikhov (N. I.) & Shcherbakova (O. A.).] Шихов (H. И.) и Щербакова (O. A.). L'influence du saupoudrage antipaludique du riz dans les conditions du territoire d'Azov et de la Mer Noire. [In Russian.]—
Med. Parasit. 6 no. 5 pp. 683–695, 10 refs. Moscow, 1937. (With a Summary in French.)

In view of cases of reduction of the yield of rice in northern Caucasus believed to be due to dusting with Paris green against Anopheline larvae [cf. R.A.E., B **25** 113], laboratory and field experiments were carried out near Krasnodar to test the effect on rice of Paris green (containing 53·7 per cent. As₂O₃ and 4·8 per cent. free As₂O₃), calcium

arsenite (containing 57.8 per cent. As₂O₃ and 7.3 per cent. As₂O₅), and oleogumbrin [25 68], which was used alone and in combination with the arsenicals. They were mixed with road dust in such proportions that the road dust was applied at rates equivalent to 4.5 lb. per acre in the laboratory and 11.9 lb. in the field. of dusting rice plants in varying stages of development grown in enamel pans in the laboratory, and of applications in the field during the sprouting, tillering, flowering and waxy ripeness of the rice, by means of a small-meshed sieve with a double muslin bottom are given in tables. Rice was not injured by applications of Paris green or calcium arsenite at rates of 0.9 and 0.7 lb. per acre, respectively, but the former slightly scorched the leaves at 1.4 lb. per acre. Calcium arsenite did so at rates above 0.7 lb. and scorched the stems at 1 lb., killing 9-10 per cent. of the plants. Oleogumbrin, either alone or in combination with the other insecticides, caused no injury at rates of up to 1.8 lb. per acre. The yield of the crop and the development of the vegetative parts of the plants were not affected by applications of Paris green or calcium arsenite (alone or with oleogumbrin), at rates of up to 0.45 and 0.54 lb. per acre, respectively. Analysis of the grains of plants dusted in the laboratory with calcium arsenite at the rate of 0.7 lb. to the acre showed them to contain only slight traces of arsenic. In the field experiments, 0.01 mg, arsenic per 30 gm, grain was detected when the calcium arsenite was applied at the rates of 0.54 and 0.72 lb. per acre.

In special laboratory experiments, 100 per cent. mortality of Anopheline larvae was given in 3 hours by Paris green or calcium arsenite at the rates of 0.45 and 0.54 lb. per acre, respectively, when used alone, or at 0.18 lb. and 0.36 lb. when mixed with 4 or 1½ parts

oleogumbrin, respectively.

[Popov (V. M.).] Nonob (B. M.). Matériaux sur la biologie d'A. maculipennis de l'arrondissement de Narym. [In Russian.]—Med. Parasit. 6 no. 5 pp. 696-706, 2 graphs, 12 refs. Moscow, 1937. (With a Summary in French.)

An examination was made in 1935-36 of over 1,000 females, 40 batches of eggs and the hypopygia of 22 males of Anopheles maculipennis, Mg., collected in various localities in the district of Naruim in Western Siberia [cf. R.A.E., B 14 53]. Race messeae, Flni., predominated, and the typical maculipennis was rare. began to abandon their hibernation quarters in May and continued to do so for a month or six weeks, depending on the temperature of the air. Some of them emerge when the mean temperature in May rises to 9-10°C. [48·2-50°F.], but disappear again during the spells of cold weather that generally follow, though it is not known whether they die or again enter hibernation; and others appear when the weather becomes warmer again in June. Owing to this, the adults abandoning their hibernation quarters form two sharply defined groups. complete generations developed in 1935, but in 1936 the second was only partial, owing to cold weather in June. In the day-time, the adults congregated chiefly in cow-sheds or in stables situated close to water; hardly any were found in workmen's huts.

Considerable numbers of females were found hibernating in the basements of inhabited houses. Of 700 apparently suitable hibernation quarters examined, 15.6 per cent. were infested. In these, the mean

temperature from mid-October till mid-March fluctuated between 2.3 and 4.9°C. [about 36-41°F.] and the relative humidity averaged 81-92 per cent., under which conditions a number of Anophelines survived the winter. Single individuals occurred in inhabited rooms during all the winter months, having probably entered them from the basements through cracks in the floor; some contained blood in April and in one instance man was attacked as early as January. Some individuals of race messeae were found hibernating in a cow-shed with very thin walls in which the temperature remained between -30 and -35 °C. $[-22 \text{ and } -31^{\circ}\text{F.}]$. Although towards the end of the winter they were covered with a thick layer of frost, a large number of them revived in April-May. The distribution of mosquitos in their hibernation quarters depended on light; in basements that were provided with windows, they concentrated in dark corners and when disturbed flew to the window [cf. 25 141]. In dark basements, they were distributed more or less evenly on the walls near the ceiling.

[ZHELOKHOVTZEV (A. N.).] **Henoxobyeb** (A. H.). Notes sur la synonymie des anophèles paléarctiques. [In Russian.]—Med. Parasit. 6 no. 5 pp. 707-709, 6 refs. Moscow, 1937. (With a Summary in French.)

The author has examined the types of Anopheles alexandrae-schingarevi, Shing., A. sacharovi, Favr, and A. martinius, Shing., over 2,000 examples of A. sacharovi taken near Samarkand, examples of A. elutus, Edw., identified by Edwards in 1925, and authors' descriptions. He concludes that A. alexandrae-schingarevi is not even varietally distinct from A. maculipennis, Mg. [cf. R.A.E., B 16 200; 18 95; 22 52], that A. martinius, A. elutus, and A. elutus var. elutior, Mart., are synonyms of sacharovi, and that the latter is a variety of A. maculipennis, since the difference in characters of the hypopygia in it is of the same order as in other varieties of the latter. He also concludes from examination of examples of A. algeriensis, Theo., taken in Turkestan and the description of var. turkestani, Shing. [14 129] that the latter is not a distinct variety.

[Kalita (S. R.).] Kanuta (C. P.). Les variétés d'Anopheles maculipennis Mg. de la partie sud du territoire d'Azov et de la Mer Noire. [In Russian.]—Med. Parasit. 6 no. 5 pp. 710-714, 5 refs. Moscow, 1937. (With a Summary in French.)

Of 2,675 batches of eggs laid by females of Anopheles maculipennis, Mg., taken, chiefly in animal quarters, in five widely separated districts in the west of northern Caucasus in 1936, 1,452 belonged to race messeae, Flni., 640 to race maculipennis (typicus), and 583 to race atroparrus, van Thiel [cf. R.A.E., B 23 287; 25 198, etc.]. For a study of their breeding places, it was assumed that larvae taken near a place where females of a given race were found belonged to the same race. Race messeae predominated in the plain along the basin of the river Kuban, the larvae occurring in water with a high content of organic and mineral substances and 21·4-98·8 mg. sodium chloride per litre. The typical race was present in numbers in the mountainous and hilly districts in the south of the region, the larvae occurring in fresh water fed by springs and containing very little organic or mineral matter. Race atroparrus predominated in the steppe area, the larvae occurring

in waters containing $148\cdot2-210\cdot8$ mg. sodium chloride per litre and a high percentage of organic and mineral matter. The chemical composition of the water in the various breeding places examined is shown in a table.

[CHEBOTAREV (R. S.).] **Чеботарев (P. C.)**. Cas de contagion de l'homme par la gale du chat, provoquée par l'ixode *Notoedres cati*. [*In Russian*.]—*Med. Parasit*. 6 no. 5 p. 715. Moscow 1937.

An instance is recorded of dermatitis caused by *Notoedres cati*, Hering, in a woman in Kiev in 1936. She had apparently become infested from a cat that slept in her bed.

[M. R.] M. P. Flies and intestinal Infections. [In Russian.]— Social. Sci. Tech. 5 no. 9 pp. 93-94. Tashkent, 1937.

In investigations by E. Ya. Sterngold on the part played by *Musca domestica vicina*, Macq., in disseminating bacteria that cause enteric diseases in Tashkent, flies were caught on vegetable, fruit and meat stalls in markets and 170 cultures were made of the material washed from their exterior and 200 of suspensions prepared from their digestive tracts. Large numbers of bacteria of the intestinal group were obtained, chiefly in cultures of the digestive tracts, and in 18 cases *Bacillus dysenteriae*. Under experimental conditions, various bacteria survived in the flies for up to 12 days [cf. R.A.E., B 23 53], and were disseminated in their faeces. It is concluded that, if B. dysenteriae occurs on the surface of the flies in Tashkent, it is soon killed by the sun and dry air, but that it is preserved and possibly propagates in their digestive tracts. It is known to survive on the surface of vegetables and fruits for from 2 to 17 days.

Bedford (H. W.). Entomological Section. Agricultural Research Service. Veterinary Entomology.—Rep. agric. Res. Serv. Sudan 1936 pp. 51-52. [Wad Medani, 1937.] [Recd. May 1938.]

To determine whether it is possible to keep working bulls free from trypanosomiasis during the rains if reasonable precautions are taken, an experiment was carried out in the Nuba Mountains District of the Anglo-Egyptian Sudan, in which 3 pairs of bulls were all protected as far as possible from insect attack by means of smoke fires at night and were not allowed to graze in contact with other cattle (although sheep, goats and donkeys grazed nearby in two of the experiments). They were housed, respectively, on cotton soil (normally low-lying and with poor drainage), in a valley of a rocky hill, and on the slope of a rocky hill. None of them contracted the disease, although there was a high mortality among bulls kept under less stringent conditions, some of which had already passed several seasons in the area. There was no appreciable difference in the number or species of biting flies in the three different situations.

Lamborn (W. A.). Some Features in the Life History of Tabanidae in Nyasaland.—E. Afr. med. J. 15 no. 2 pp. 46-50, 3 refs. Nairobi, May 1938.

Notes are given on the breeding habits of several species of Tabanids in Nyasaland and particularly on the mud cylinders made by the

larvae of *Tabanus biguttatus*, Wied., *T. taeniola*, P. de B., and *T. fraternus*, Macq., to protect the puparia from exposure when the general cracking of the mud takes place after the cessation of the rains [cf. R.A.E., B 18 104].

Macindoe (R. H. F.). The Poultry Stickfast Flea (Echidnophaga gallinacea).—J. Dep. Agric. S. Aust. 41 no. 8 pp. 732-735. Adelaide, March 1938.

A popular account is given of the bionomics and control of Echidnophaga gallinacea, Westw., in South Australia, where it may be a serious pest of fowls and also infests pigeons, dogs, cats and rodents in the sandy areas of the State. The features of the biology on which recommendations for control are based are that the fleas usually oviposit at night and that the larvae are killed by dryness and heat or by excessive moisture. When an infestation is observed, fowls should be placed in wire-netting enclosures kept free from litter and manure, the lower limbs of shady trees should be removed so that all parts of such enclosures may be exposed to sunlight at some time during the day, and water receptacles and nesting boxes should be moved frequently to allow the ground beneath them to dry out. In poultry houses, the floor should be of impervious material, such as cement, into which the larvae cannot penetrate, or it should be kept saturated with water; one dressing of quicklime should be given. Manure should be removed at least twice a week; it should be burned or buried deeply, or, if required as a fertiliser, should be covered with water for a week or spread in a thin layer where the heat of the sun will kill the larvae. The comb and wattles of infested birds should be treated once a week with a non-irritating oil. The nests should be constructed of iron or of kerosene tins, and should be raised off the ground and bedded with shell grit or coarse sand. Egg boxes should be kept clean, and should not be stored near poultry. Oil dressings should also be applied to infested dogs and cats and all bedding should be cleaned by scrubbing or boiling and then exposed to strong sunlight. Rabbits, rats and mice should be destroyed, and the carcasses burned or deeply buried.

Spencer (G. J.). Further Notes on the Fleas of British Colombia.—

Proc. ent. Soc. B. C. no. 34 pp. 36-38. Victoria, B.C., February 1938.

A list is given of eight species and one variety of fleas from British Columbia recently described as new by J. Wagner, two of which were included in the 61 species already listed by the author [R.A.E., B] 24

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Further outbreaks of cat and dog fleas [Ctenocephalides felis, Bch., and C. canis, Curt.], particularly the latter, have been recorded in dwellings in Vancouver [cf. loc. cit.] and in nearly every case the fleas were associated with sawdust fuel and spread from the basement to the living rooms; in some instances cats, dogs or both were present, in others neither. Proof was obtained that fleas were taken into one uninfested house in sawdust. Observations on cats and a dog have shown that these animals play on the sawdust but do not lie in it [cf. loc. cit.]. The fleas are abundant at the edge of the sawdust. The summer climate of Vancouver seems to be especially suitable for fleas and they can flourish in any house where a little dust accumulates,

provided that it is sufficiently damp. It is recommended that infested basements be sprayed with any fly spray and a thin layer of fresh cedar sawdust sprinkled all over the floor and around the sawdust bin. Since fleas thrive in damp ill-ventilated places, basements should be kept as dry as possible by allowing currents of dry summer air to pass through them.

BABCOCK (O. G.). Sulphur Dips for the Control of Goat Lice.—Sthwest Sheep & Goat Raiser 7 no. 17 pp. 5, 28; 1937. (Abstr. in Exp. Sta. Rec. 78 no. 6 p. 829. Washington, D.C., 1938.)

In experiments in Texas, dips found safe and efficient for the control of various lice on goats were made with finely ground sulphur (98–100 per cent. passing through a 325-mesh screen) or flotation sulphur prepared by the liquid purification process and further freed from traces of iron and arsenic sulphide left by its manufacture. Two dippings with an 11-day interval are recommended, using 10 oz. of either form of sulphur per 100 U.S. gals., with the addition of 10–25 oz. trisodium phosphate, the amount depending on the hardness of the water.

Stearns (L. A.). Important Insects of the Year.—Bull. Del. agric, Exp. Sta. no. 207 (Rep. 1936–37) pp. 29–30. Newark, Del., September 1937. [Recd. June 1938.]

Bugs found infesting a house in Delaware in August 1936 were identified as Cimex pilosellus, Horv. They were associated with the presence of bats (Myotis lucifugus) in a garret above a shop adjoining the residence. According to the literature, C. pilosellus does not thrive on human blood and seldom attacks man [cf. R.A.E., B 14 209; 23 209], but in this case painful bites were reported. The infestation was brought to an end by removing the guano and other débris from the garret, driving out the bats, closing all points of entrance, and destroying the bugs by thorough spraying with creosote oil

Owen (W. B.). The Mosquitoes of Minnesota, with special Reference to their Biologies.—Tech. Bull. Minn. agric. Exp. Sta. no. 126, 75 pp., 11 figs., 41 refs. St. Paul, Minn., November 1937. [Recd. June 1938.]

In the first part of this paper, the author discusses the economic importance of mosquitos in Minnesota, the question of their relation to such diseases as malaria, equine encephalomyelitis, fowl pox and tularaemia, all of which occur in the state, and the details of the method of study. In the second, he outlines the topography and climate of the state, describes the types into which the mosquito breeding places may be grouped and shows in a table the number of times the larvae of the different species were found in association. In the third part, he summarises the more technical external characters used in identification, gives a list of the 37 species belonging to 7 genera occurring in Minnesota, a non-technical key to the adults based on characters that are easily recognisable, and a series of technical keys to the genera, based on adults and larvae, and to the species of *Anopheles, Aëdes, Culex* and *Theobaldia*, based on the adults, male hypopygium and larvae, and finally deals with the species

separately, giving the characters by which each may be distinguished, and notes on its life-cycle, larval habitat, importance and distribution. The known distribution of 33 species is shown on maps.

Pereira (C.). Dados ecologicos sobre ovos e nymphas hexapodas de Boophilus microplus (Canestrini, 1888). [Ecological Data on the Larvae of B. annulatus microplus.]—Arch. Inst. biol. 8 pp. 135-144. S. Paulo, 1937. (With a Summary in English.)

Notes are given on preliminary investigations in São Paulo on eggs and larvae of *Boophilus annulatus microplus*, Can. Eggs of this tick, placed singly on water, floated until pushed down, when they sank to the bottom. Egg clusters did not remain submerged until the air bubbles in the interstices were dispelled. Floating eggs hatched in the normal period of 41 days, and 25 per cent. of those kept submerged hatched in 55 days. In both cases, the larvae congregated at the bottom of the vessel. Eggs shrivelled up when they were kept in a dry tube after submersion and when they were buried under fine, heat-dried sand or garden soil, but when buried under dry, but not heat-dried, sand or soil, or moist sand or soil, they hatched in the usual period.

Larvae floated when placed on water and lived for 73 days when submerged in water renewed weekly, being apparently able to use the oxygen dissolved in the water. Larvae submerged for periods varying from 5 minutes to 1 week, or kept in a tube with wet filter paper for 30 minutes, and then transferred to dry tubes all died within 8 days of transference, whereas controls survived for 1 month. Larvae placed for 5 minutes under a beam of light showed no sort of reaction, but a sudden change in temperature from 22 to 38°C. [71·6 to 100·4°F.] caused them to move about rapidly for some time, after which they

again became motionless.

Larvae of B. a. microplus in tubes of up to 3 ft. in length remained near the bottom, grouping themselves alongside each other, whereas those of Amblyomma maculatum, Koch, climbed well upwards and their groups included layers of superposed individuals. Larvae of A. cajennense, F., were found in such layered groups on plants in pastures. On a grass-plant in the laboratory, newly-hatched larvae of Boophilus crawled between the sheathing leaves and the stem. When disturbed by being breathed upon, they dispersed and then gradually returned to their refuges. When placed on earth, they sheltered in cracks. Larvae placed on the forearms and legs of men did not bite.

MAZZA (S.) & JÖRG (M. E.). Investigaciones sobre la enfermedad de Chagas. II. Tercera nota sobre Triatomidae (Hemipt. Het. Reduvioidea) argentinos. [Investigations on Chagas' Disease. II. Third Note on Argentine Triatomids.]—Publ. Misión Pat. reg. argent. Jujuy no. 36 pp. 26-58, 21 figs., 6 pls. Buenos Aires, 1938.

Detailed descriptions are given of all stages of *Eutriatoma sordida*, Stål, and *Triatoma platensis*, Neiva, together with records of the distribution of the former in Brazil, Bolivia, Argentina and Uruguay and of the latter in Argentina. Observations in Brazil on the parasitism of the egg of *Panstrongylus megistus*, Burm., by *Telenomus fariai*, Costa Lima [R.A.E., B 15 235; 17 53] are reviewed, and the finding in Argentina of eggs of *Triatoma infestans*, Klug, parasitised by this Scelionid, is recorded.

GENEVRAY (J.), TOUMANOFF (C.) & HOANG-TICH-TRY. Etude préliminaire d'un foyer de paludisme épidémique dans une localité du delta tonkinois.—Bull. Soc. méd.-chir. Indochine 15 no. 10 pp. 1138–1157, 4 figs., 1 fildg. map, 10 refs. Hanoi, December 1937.

An account is given of an outbreak of malaria that occurred in 1937 in a group of four hamlets in the delta region of Tonkin about 9 miles from Hanoi. The 320 Anopheline larvae taken in October and November in the most affected hamlet comprised Anopheles hyrcanus var. sinensis, Wied. (73 per cent.), A. aconitus, Dön. (16 per cent.) and A. vagus, Dön. (11 per cent.). The numbers of adults of these species that were caught were 448, 217 and 247, respectively, and in addition 8 examples of A. tesselatus, Theo., 1 of A. hyrcanus var. nigerrimus, Giles, and 1 of A. jeyporiensis, James. Of 67 females of A. aconitus taken in the most affected hamlet, two showed sporozoites in the salivary glands; dissections of other species including 189 examples of A. hyrcanus var. sinensis from the same hamlet gave negative results. Of engorged females taken in dwellings, 7 out of 17 of A. aconitus and 8 out of 24 of A. hyrcanus var. sinensis contained human blood; all of 8 of A. vagus contained only animal blood. Borrow pits made in the course of constructing a dike proved to be important breeding places, and were more so near the most affected hamlet, where they were numerous and had formed lakes, than near the other hamlets, where they were fewer and had been transformed into cultivated rice-fields.

SWEET (W. C.) & RAO (B. A.). Measurements of A. culicifacies Ova.— J. Malar. Inst. India 1 no. 1 pp. 33-35, 4 refs. Calcutta, March 1938.

The following is substantially the authors' summary: Average measurements of length, greatest breadth, length of float, number of ridges on the float, and proportion of length covered by float, are given for 1,994 ova from 66 females of *Anopheles culicifacies*, Giles, caught wild in five different parts of India. Females of this mosquito showing malaria parasites in the salivary glands have been found in four of these places and not in the fifth, but as neither the patterns nor the measurements of the eggs varied significantly [cf. R.A.E., B **26** 50] there is no indication that the differences in infection rates are due to the existence of races or varieties.

BARBER (M. A.) & RICE (J. B.). Malaria in Poona and in its Vicinity.—

J. Malar. Inst. India 1 no. 1 pp. 37-55, 3 refs. Calcutta,

March 1938.

An account is given of investigations on malaria in Poona and the surrounding country, carried out from 4th February to 1st August 1937, a period including all the hot dry season and about 6 weeks of the cool, rainy weather that accompanies the south-west monsoon. Malaria indices in the urban area were generally low, except in the neighbourhood of one of the rivers that traverse the city. Much higher indices were found in the rural areas, especially where they are irrigated by canals or streams. Several species of Anophelines were taken. Anopheles culicifacies, Giles, was the most abundant, being very plentiful in some localities even during the dry season. Among 1,640 Anophelines dissected, it was the only species infected, three

females having sporozoites in the salivary glands. Precipitin tests showed that the cow is the preferred host of all the species tested; reactions to human antisera were shown only by A. culicifacies, A. subpictus, Grassi, and A. fluviatilis, James, the percentages of the positive results being 1·9, 0·45 and 4·6, respectively. Anophelines bit much more frequently during the dry, hot season than during the beginning of the humid season, when, in this region, there is a definite decrease in temperature and all biological processes are slowed down; possibly at a later period, when humidity and high temperature coincide, there is an increase in the numbers of mosquitos containing human blood and sporozoites. A. culicifacies appears to be the most important vector, at least during the dry and early monsoon periods; A. fluviatilis may also be concerned in transmission in some seasons and localities.

Various improvements in technique are briefly described in an addendum. For catching mosquitos resting on a thatched ceiling, a large white umbrella with the handle sawn off a little below the catch is held open, upside down, under the ceiling and the mosquitos, stupefied by a small amount of spray, fall into it and may be shaken into a bottle or picked up with forceps. A long piece of bamboo may be fixed to the point of the umbrella if the ceilings are high. Food for rearing mosquito larvae may be obtained by filling a tall glass beaker about one-third full with garden earth, adding tap water up to the brim, and covering it with a piece of coarse mosquito netting to serve as a strainer and prevent stray mosquitos laying their eggs in it. Within a few days at high room temperature (28-30°C. [82·4-86°F.]), the water is swarming with bacteria and infusoria and may be poured into the larval cultures. The beaker is then refilled with water and can be used repeatedly; the permanence and productiveness of the earth culture can be increased by mixing in small pieces of ordinary cooking gelatine, fresh or rotten algae, or almost any other organic material. A small piece of cellophane may be used as a cover glass when examining larvae, since it is just heavy enough to immobilise without crushing them and clear enough to enable almost any characteristic useful in identification to be seen.

Dogra (J. R.). A Malaria Survey of Bannu Cantonment (1932-33).— J. Malar. Inst. India 1 no. 1 pp. 57-81, 3 pls., 3 maps, 1 diagr. 2 graphs, 4 refs. Calcutta, March 1938.

The following is substantially the author's summary: A malaria survey of Bannu Cantonment (North-West Frontier Province) carried out in 1932 and 1933 is recorded. Innumerable irrigation channels traverse the entire area of the cantonment and its neighbourhood and are the main mosquito breeding places. The common species of Anopheles found were A. stephensi, List., A. culicifacies, Giles, and A. subpictus, Grassi. Brief mention is made of the organisations responsible for planning and carrying out antimalaria measures and of the measures themselves, which included fumigating and spraying against adult mosquitos resting in buildings, the filling and draining of breeding places, their treatment with oil or Paris green, or, in the case of the smaller irrigation channels, their complete drying out once a week. The Bannu district is very malarious; the numbers of cases begin to rise towards the end of August, reach their maximum in October and November, and then decrease rapidly.

SEN (P.). Anopheles sundaicus (ludlowi) and Malaria in Calcutta.— J. Malar. Inst. India 1 no. 1 pp. 83-98, 1 ref. Calcutta, March 1938.

Details are given of the spleen and parasite rates in localities in several wards of Calcutta and in adjacent areas on the east and southeast, where epidemics of malaria occurred in 1936. Breeding of Anopheles sundaicus, Rdnw., in the neighbourhood of Calcutta, especially in the salt lake areas [cf. R.A.E., B 24 164, 257], was profuse in 1935 and 1936, owing to the suspension of control operations in them at the end of February 1935. During the epidemic, this species was breeding in the various wards affected, and almost every malarious zone in the City could be directly associated with a separate breeding focus. Records are given of the species of Anophelines occurring in the several localities, the relative incidence of their adults and larvae, and the number of breeding places of A. sundaicus. A. subpictus, Grassi, was the predominant species and A. sundaicus was second in numbers in all but one locality, in which it was the most abundant. Of 124 females of A. sundaicus from one of the infected localities, two contained sporozoites and two others contained oocysts. Malaria had never occurred in a serious form within the city before the advent of A. sundaicus in the areas at the edge of it.

Extract from the Report of the Intergovernmental Conference of Far Eastern Countries on Rural Hygiene, held at Bandoeng, Java, 3rd to 13th August, 1937. Recommendations regarding Malaria.

—J. Malar. Inst. India 1 no. 1 pp. 99-104. Calcutta, March 1938.

The recommendations reported in this paper were made after a series of discussions, not only by technical experts but also those having executive experience, and are an attempt to indicate some practical lines of procedure as regards public policy in dealing with the control of malaria in the rural parts of countries in the Far East. With reference to the control of Anopheline larvae, it is suggested that "naturalistic methods" [cf. R.A.E., B 23 130; 25 263] should be further investigated, since they are relatively cheap and can often be applied by the peasant populations. Such methods include the use of larvivorous fish, the packing of streams, drains, etc., with green vegetation, the shading of breeding places or the complete removal of shade, periodic sluicing of streams, changing the salt content of water or altering its surface level, and making use of the natural tendency of rivers to deposit silt, to flood or to flush.

COVELL (G.), MULLIGAN (H. W.) & AFRIDI (M. K.). An Attempt to Control Malaria by the Destruction of Adult Mosquitoes with Insecticidal Sprays.—J. Malar. Inst. India 1 no. 1 pp. 105-113, 1 ref. Calcutta, March 1938.

During 1936, an attempt was made to control malaria in the railway quarters, Sabzimandi [cf. R.A.E., B 26 148], and in three other selected communities living under controlled conditions in the Delhi urban area by destroying mosquitos in houses with a pyrethrum spray (Pyrocide 20 diluted with 19 times its volume of kerosene). The spray was applied at the rate of 1–2 cc. per 1,000 cu. ft. The results, as estimated from the drop in the spleen rates and the decrease

in the number of malaria cases, were so encouraging that a further trial was carried out on a larger scale during the malaria season (July-October) of 1937 in two villages on the south-eastern edge of New Delhi, where malaria is hyperendemic, and where the chief and probably the only vector is Anopheles culicifacies, Giles, which, in this area, appears to rest during the daytime in human dwellings and cow-sheds in their vicinity. Since large spleens cannot be expected to recede to a position above the costal margin in a single season, it is difficult to assess the value of control measures from spleen rate alone. was a striking fall in the number of fever cases treated at the dispensary in one of the villages, which suggests that some benefit was derived from the measure, but the dispensary serves other villages besides those treated and the incidence of malaria during 1937 was abnormally low in the villages near Delhi. Dissection of 1,479 females of A. culicifacies from the treated villages revealed one with infected salivary glands in July (within a week of the commencement of spraying), while dissections of 1,028 females from an untreated village revealed two infections (one in the gut and one in the salivary glands), both in September. Although it is difficult to assess with accuracy the value of the spraying operations, it can be stated that the cost compares very favourably with that of temporary anti-larval measures.

Subba Rao (A. M.), Sweet (W. C.) & Rao (B. A.). Measurements of Wings of two Forms of A. stephensi.—J. Malar. Inst. India 1 no. 1 pp. 115-117, 2 refs. Calcutta, March 1938.

Measurements of the length and breadth, excluding fringe, of the wings of the two forms of *Anopheles stephensi*, List., found in India were made in the course of studying the eggs [cf. R.A.E., B **26** 49]. Although the differences between the means of the two forms for these two measurements may possibly be significant, they are so slight as to render problematical the utility of the measurements as a practical method for identifying the females before they have laid eggs. There was no significant difference in the means of the proportions of the wings, as represented by the relation of breadth to length.

Manson (D.). A Method of Anti-larval Oiling for Rivers.—Indian med. Gaz. 73 no. 5 pp. 284-285, 2 figs., 3 refs. Calcutta, May 1938.

Regular oiling of the edges of rivers is necessary during the monsoon season in Assam in malarious areas where large numbers of labourers are employed (as in tea gardens), because larvae of Anopheles minimus, Theo., the principal vector of malaria, have been found in abundance in culs-de-sac in the river banks or at the edges of rivers or streams in the intervals between heavy falls of rain when the velocity of the current drops below 2 miles per hour [cf. R.A.E., B 24 204]. To economise oil, a method was devised in which breeding areas near the river bank were enclosed by placing a short piece of bamboo (about 3 ft. long) at each end of the area at right angles to the bank, resting their inner ends on the bank and connecting their outer ones by longer bamboo poles lying parallel to the bank. The floating rectangular enclosure formed was divided in half by a third short bamboo. The oil was first sprayed on the upper half and after it had remained for a sufficient time to destroy the mosquito larvae (15–20 minutes when Malariol is employed), the dividing bamboo was removed and the oil

was allowed to flow into the lower half. The method was effective but cumbrous and wasteful, and a second method was devised to make the application of the oil easier and more economical. A length of coarse sacking (about 3 ft. wide and 15–20 ft. long) with as wide a mesh as possible has light strips of wood or bamboo attached across the upper side at intervals of 2–3 inches. The sacking mat formed is well oiled with Malariol, rolled up and taken to the river bank, and unrolled quickly over the breeding area; one long edge rests on the bank and the rest of the mat is kept afloat by the slats of wood. After 15–20 minutes, it is rolled up again and is ready for use elsewhere. Little of the oil is washed away by the water, and the mat may be applied 3 or 4 times before the supply of oil need be renewed. The mat can easily be carried by one man, it can be applied quickly, and the amount of oil used is not more than half that required by the method previously used.

EVANS (A. M.). Mosquitoes of the Ethiopian Region. II.—Anophelini. Adults and Early Stages.—Roy. 8vo, x + 404 pp., 174 figs., 6 pp. refs. London, Brit. Mus. (N.H.), 1938. Price £1.

This posthumous work is in the form in which the author wrote it, except for a few interpolations and the description of three new species by F. W. Edwards. So much additional information on the Anophelines of the Ethiopian region (tropical and south Africa, the adjacent islands and south-western Arabia) has recently been obtained that the author's previous work on this subject [R.A.E., B 24 123] has had to be completely revised. The number of species recognised has increased from 30 to 60, and of varieties from 6 to 21.

In the first part, the bionomics and distribution of Anophelines, the structure of the adult, pupa and larva, and the technique of mounting the pharynx, male terminalia and egg are discussed, and a list is given of the species and varieties. The second part consists of keys to the adults and larvae, and a shorter key to the adults of the domestic species, which include most of the proved vectors of malaria. In the third part, descriptions are given of all the known stages of each species, with notes where possible on its synonymy, breeding places, the habits of the adults, relation to malaria and distribution. The new species described are *Anopheles concolor*, *A. dureni* and *A. mortiauxi*, from Kwango Province, Belgian Congo.

LAVEZZONI (P.). Contributo allo studio della malaria dei tropici. [A Contribution to the Study of Malaria in the Tropics.]—G. ital. Clin. trop. (N.S.) 2 no. 2 pp. 39–40, 43–6, 49–52, 55, 5 refs. Naples, 28th February 1938.

In the middle and lower plains of western Eritrea, the rains last from July to September, and the incidence of malaria shows an increase in July and again from September to November. These are the periods during which Anopheline breeding places are to be found; they do not occur in the dry season, and those formed at the onset of the rains are subsequently washed out. Besides the river pools, collections of water are formed in hollow baobab trees [Adansonia digitata], and the author has repeatedly observed Anophelines breeding in them.

Franchini [R.A.E., B **20** 73] has recorded the Anophelines as *Anopheles gambiae*, Giles, and *A. coustani*, Lav. (mauritianus, Grp.), while other workers have found *A. maculi pennis*, Mg. *A. gambiae* predominates.

CORRADETTI (A.). L'anofelismo nella regione del Semien durante la stagione secca. [Anophelism in the Simen Region during the dry Season.]—Boll. Soc. ital. Biol. sper. 13 no. 2 pp. 114-115. Milan, 1938.

Anopheline larvae found in late April and May 1937 along the Aksum-Gondar road in northern Abyssinia at an altitude of 3,000—4,000 ft. were *Anopheles d'thali*, Patt., and *A. pretoriensis*, Theo., both unimportant as vectors of malaria [but cf. R.A.E., B **26** 67, 68]. No locally acquired cases occurred during this period.

CORRADETTI (A.). La malaria nella regione Uollo-Jeggiu nel periodo Luglio-Ottobre 1937. [Malaria in the Uollo-Jeggiu Region in the Period July-October 1937.]—Boll. Soc. ital. Biol. sper. 13 no. 2 pp. 115-116. Milan, 1938.

A brief account is given of a malaria survey in the part of the Abyssinian high plateau round Dessie in July-October 1937. Malignant tertian (*Plasmodium falciparum*) was the predominant form of the disease. *Anopheles gambiae*, Giles, the chief vector, was abundant in dwellings and its larvae were found in many very diverse breeding places. It occurred up to an altitude of about 6,000 ft., the limit of endemic malaria, and its local distribution coincided with that of the disease. Precipitin tests showed that 57.4 per cent. of 214 females had fed on man. The other Anophelines found were *A. pretoriensis*, Theo., *A. christyi*, Newst. & Cart., *A. coustani (mauritianus)* var. *paludis*, Theo., and *A. garnhami*, Edw.

CORRADETTI (A.). Due specie di Anopheles rinvenute nella valle di Mai Habar (Eritrea) nell'Ottobre 1937. [Two Species of Anopheles found in the Mai Habar Valley (Eritrea) in October 1937.]—
Boll. Soc. ital. Biol. sper. 13 no. 2 p. 117. Milan, 1938.

Numerous larvae of *Anopheles pretoriensis*, Theo., and *A. cinereus*, Theo., were found in pools in a stream bed about 100 yards from a camp in the Mai Harrar Valley at an altitude of about 5,000 ft. and some 18 miles from Asmara. No adults were taken in the habitations and no cases of locally acquired malaria occurred among over 25,000 workmen who had passed through the camp.

PAPERS NOTICED BY TITLE ONLY.

- Ohmori (N.). Studies on the tropical Rat Mite [Liponyssus nagayoi, Yamada, in Formosa]. Third Report. Its Biology and Control. [In Japanese.]—J. med. Ass. Formosa 36 no. 12 (no. 393) pp. 2589–2608, 1 pl. Taihoku, Formosa, December 1937. (With a Summary in English.) [Cf. R.A.E., B 25 19, 220.]
- Delpy (L.). Morphologie et disposition des stigmates respiratoires chez les larves hexapodes des Ixodidae.—Bull. Soc. Path. exot. 31 no. 4 pp. 298-300. Paris, 1938.

- PINKERTON (H.) & HASS (G. M.). The Identification of Dermacentroxenus rickettsi and its Differentiation from non-pathogenic rickettsiae in Ticks.—J. exp. Med. 66 no. 6 pp. 729–739. New York, N.Y., 1937. (Abstr. in Exp. Sta. Rec. 78 no. 5 pp. 695–696. Washington, D.C., May 1938.)
- Gregson (J. D.). Notes on some phenomenal Feeding of Ticks [Dermacentor venustus, Banks (andersoni, Stiles)].—Proc. ont. Soc. B.C. no. 34 pp. 8-11, 4 figs., 3 refs. Victoria, B.C., February 1938.
- Spencer (G. J.). Ectoparasites of Birds and Mammals of British Columbia. II. A preliminary List of the Pupipara, Louse Flies.—Proc. ent. Soc. B.C. no. 34 pp. 39–45, 11 refs. Victoria, B.C., February 1938.
- WAGNER (J.). Aphanipterologische Notizen. V. Ueber die Rassen von Ctenophthalmus orphilus J. & R. und Ct. nivalis R., und die Vergleichung des Ceratophyllus garei R. mit C. borealis R. nebst einer Feststellung von Ceratoph. garei islandicus ssp. n. [On the Races of C. orphilus and C. nivalis, and the Comparison of C. garei with C. borealis and a Record of C. garei subsp. islandicus, n. (from a bird's nest in Iceland).]—Konowia 16 pt. 3-4 pp. 252-257, 5 figs. Vienna, 1st May 1938.
- [KAMALOV (N. G.).] Kamanob (H. F.). Au sujet de la biologie de Phlebotomus caucasicus (Marzinovsky, 1917) [in Transcaucasia]. [In Russian.]—Med. Parasit. 6 no. 4 pp. 556-560, 1 fig. Moscow, 1937. [Cf. R.A.E., B 22 122.]
- [Latuishev (N. I.).] Латышев (H. И.). Infections transmitted by Phlebotomus—Sandfly Fever, Leishmaniasis. (Review of the Literature.) [In Russian.]—Med. Parasit. 6 no. 4 pp. 561-572, 89 refs. Moscow, 1937.
- [Butyagina (A. P.), Shmeleva (Yu. D.) & Vitebskaya (V. A.).] Бутбина (А. П.), Шмелева (Ю. Д.) и Витебская (В. А.). Observations suivies de l'organisation de la prophylaxie mécanique (moustiquaire et grillages) des tourbières. [Experiments with mosquito nets and screening of huts against mosquitos in the Province of Moscow in 1934.] [In Russian.]—Med. Parasit. 6 no. 5 pp. 666-678, 4 graphs, 5 refs. Moscow, 1937. (With a Summary in French.) [Cf. R.A.E., B 26 48.]
- GALVÃO (A. L. Ayrosa) & LANE (J.). Nota sobre os Nyssorhynchus de S. Paulo. VII. Estudo sobre as variedades deste grupo com a descrição de Anopheles (Nyssorhynchus) albitarsis Arrib., 1878 var. limai n. var. [A Study of the Species of the Nyssorhynchus Group in São Paulo and their Varieties (including keys to the females, male terminalia and eggs), with a description of Anopheles (N.) albitarsis var. limai, n.]—Ann. Fac. Med. Univ. S. Paulo, 13 pp. 211–238, 12 figs., 2 pls., 9 refs. S. Paulo, 1937. (With a Summary in English.) [Recd. June 1938.]
- COVELL (G.). The Malaria Survey of India, 1927-37 [its history and work, including a list of publications].—J. Malar. Inst. India 1 no. 1 pp. 1-31, 4 pls. Calcutta, March 1938.

Schwetz (J.). Contribution à l'étude des moustiques de quelques localités du Bas Congo et du Kwango.—Ann. Soc. belge Méd. trop. 18 no. 1 pp. 89-113, 1 fldg map, 10 refs. Brussels, March 1938.

Notes are given on the mosquitos, particularly the Anophelines, taken in various localities in the Bas Congo and Kwango districts of the Belgian Congo during 1936. Observations at Banana confirmed those of Wanson [R.A.E., B 24 107] that Anopheles gambiae, Giles, is the only Anopheline present. At Boma, A. gambiae, A. funestus, Giles, A. nili, Theo., and A. pharoensis, Theo., were collected. In the Mayumba region, all these species were taken and, in addition, A. moucheti, Evans, and A. hancocki, Edw., which has not previously been recorded from the Belgian Congo. Except in places where there were papyrus swamps, Anophelines were much more numerous in dwellings than other mosquitos, which is also the case elsewhere, but in this region A. funestus, and not A. gambiae, was the predominating species, and A. nili, which is rare or often entirely absent in other places, was as common as A. gambiae; A. pharoensis was rare. The Anophelines collected at Thysville and other places in the region of cataracts were A. gambiae, A. funestus, A. marshalli, Theo., A. nili, A. coustani, Lav. (mauritianus, Grp.), and A. hancocki.

In the Kwango district collections were made at different localities in the vicinity of the river Kwango for about 150 miles above Popokabaka. The Anophelines included A. funestus, A. marshalli, A. nili, A. coustani var. paludis, Theo., A. obscurus, Grünb., and A. pretoriensis, Theo., but A. gambiae predominated to such an extent that for practical purposes it may be considered the only Anopheline of the region. A. gambiae also predominated in the region of cataracts, but

there A. funestus and the other species were not rare.

VAN HOOF (L.), HENRARD (C.) & PEEL (E.). Contribution à l'épidémiologie de la maladie du sommeil au Congo Belge.—Ann. Soc. belge Méd. trop. 18 no. 1 pp. 143-201, I fidg map, 15 figs. Brussels, March 1938.

The authors discuss at length 96 strains of Trypanosoma gambiense collected during recent years in the Belgian Congo and studied at the laboratory at Leopoldville, and, in addition, 5 other strains from the same colony studied by Rodhain and his colleagues and by Duke. In the course of the principal experiments on cyclical transmission. 19,068 examples of Glossina palpalis, R.-D., were dissected and 941 infections were observed, 610 after the 15th day [cf. R.A.E., B 22 126] and 308 in the salivary glands. The general average index of transmissibility obtained from the figures is of no significance, because the conditions of the experiments were too varied; the flies were fed on man, monkeys and guineapigs and the ability of the trypanosome to develop in them is appreciably modified by the host from which it is obtained. The indices of transmissibility when the infecting feed was taken on man, monkey and guineapig, respectively, were 3.63, 1.67 and 1.56. When flies were fed on untreated persons in whom sleeping sickness had only recently been diagnosed, the index was 4.65; when they were fed on patients harbouring arsenic-resistant trypanosomes before prolonged or inefficacious treatment had been applied, it was 4.16: when they were fed on serious cases that had already been treated (whether the trypanosomes were resistant to arsenic or not)

and had had relapses in spite of the most persevering treatments, it was 1.68. These indices suggest that prolonged treatment reduced the ability of the trypanosome to develop in the fly. When flies were fed on advanced cases that had not been treated and that were infected with trypanosomes that were not arsenic-resistant, the index was about 2.27, so that the lowering of transmissibility is only partly due to the ageing of the trypanosome in man [cf. loc. cit.]. This hypothesis is supported by individual cases in which the index of transmissibility decreased in the course of treatment. The finding that temperature has little or no effect on transmissibility [cf. 21 237] was confirmed.

Almost 5 per cent. of the strains examined were not cyclically transmissible, but in the Kongolo-Kabalo region, 8 out of the 12 strains examined were not transmissible, and only 8 flies out of 718 became infected in the salivary glands in the case of the other 4 strains. These findings indicate a local phenomenon that may be associated with the development of the endemicity of the disease in this region. The number of non-transmissible strains of T. gambiense confirms the view that this trypanosome is not dependent on man alone. It appears that, unless the stock of trypanosomes in an endemic area were renewed or supplemented by fresh strains obtained from hosts other than man, the disease would die out without the intervention of control measures. In fact, however, the endemic revives as soon as medical measures are relaxed, and the origin of the new infections often appears obscure if an animal reservoir is not admitted. If the existence of an animal reservoir is assumed, the pathogenic trypanosomes that they carry may be either human trypanosomes in which the character of cyclical transmissibility has been regenerated or a strain of T. brucei that, under influences as yet unknown, has become pathogenic to man.

In the course of this study there was observed a whole series of human trypanosomes that by their morphology, their pathogenicity for man and laboratory animals, and their resistance to arsenicals connect T. gambiense with T. rhodesiense, but the authors do not consider that the latter species occurs in the Belgian Congo [cf. 26 134]. Throughout the colony, sleeping sickness appears to be intimately and of necessity connected with the presence of G. palpalis. Although other species of Glossina have been found to be capable of transmitting the local strains in laboratory experiments, the active propagation of the trypanosome in nature has never passed beyond the zone infested by G. palpalis. This is confirmed each year by observations made in an area where only G. morsitans, Westw., exists; not only has the trypanosome not utilised this fly to extend its distribution beyond its present limits, but it has also not undergone any transformation into T. rhodesiense that would have enabled it to accommodate itself to this new invertebrate host and to new epidemiological conditions. Sleeping sickness has remained a "disease of rivers"

and has not become a "disease of the savannah."

MATHIS (M.). Biologie d'une araignée domestique du Sénégal: Plexippus paykulli (Audouin).—Bull. Soc. Path. exot. 31 no. 4 pp. 301–305, 2 figs., 3 refs. Paris, 1938.

Details are given of observations over a period of about 15 months on the biology of *Plexippus paykulli*, Audouin, reared in laboratories in Dakar (where it is common in houses) and in Paris. The adult spiders

devoured large numbers of flies and mosquitos, and even the immature spiders, which eat nothing before their second moult, are capable of destroying fully engorged mosquitos after that time. The rate of development depends on the amount of nourishment, but maturity can probably be attained in 3–4 months. The adults may survive without food for 3–4 weeks and probably live for several years. Their predilection for mosquitos, and particularly for engorged females of Aëdes aegypti, L., was confirmed [cf. R.A.E., B 21 219], and the author suggests that since they can be reared without difficulty, they might be of value in the campaign against yellow fever in Senegal.

Antunes (P. C. A.). Informe sobre una investigación entomologica realizada en Colombia. [Report on an entomological Investigation in Colombia.]—Rev. Fac. Med. Bogotá 6 no. 2 repr. 29 pp., 14 refs. Bogotá, August 1937. [Recd. 1938.]

Investigations were made from December 1934 to March 1935 in the municipalities of Restrepo and Villavicencio, on the eastern slope of the Andes, during an outbreak of jungle vellow fever [cf. R.A.E., B 24 35, 205]. The infections evidently originated in or near the forests, for most of the patients had worked there, and very few women and children were infected without leaving the settlements, which were more or less distant from the forests. Some 60 mosquitos and a number of other blood-sucking Arthropods, a list of which is given, were taken in the forests; Aëdes aegypti, L., was not found. Infection may have been transmitted mechanically in the settlements by Rhodnius prolixus, Stål, which was common in the huts and attacked man, but it is considered that if this Triatomid or the Ixodid, Ornithodorus venezuelensis, Brumpt, or Simuliids, which were also common there, were good vectors, the outbreak would have been much more Haemagogus janthinomys, Dyar, which was the most numerous of the mosquitos taken, is suspected of being the chief vector; Psorophora ferox, Humb., was very rare during this particular outbreak [cf. 24 205]. Two species of the subgenus Soperia of Aëdes [loc. cit.] were readily attracted to man, and merit study as possible vectors. Laboratory investigations [cf. 19 108; 269; 26 65] have shown that of the other species taken, Limatus durhami, Theo., Trichoprosopon (Joblotia) digitatum, Rond., and Anopheles tarsimaculatus, Goeldi, fail to conserve the virus for a period equal to that of the extrinsic incubation in Aëdes aegypti, and that Psorophora cingulata, F., Aëdes serratus, Theo., A. terrens, Wlk., Mansonia titillans, Wlk., M. juxtamansonia, Chagas, and M. fasciolata, Arrib., do not transmit infection by biting, even though injection has demonstrated the conservation of the virus in them.

Kumm (H. W.) & Novis (O.). Mosquito Studies on the Ilha de Marajó, Pará, Brazil.—Amer. J. Hyg. 27 no. 3 pp. 498-515, 2 pls., 2 maps, 1 graph, 11 refs. Baltimore, Md, May 1938.

The results are given of a study, carried out from 27th November 1935 to 26th June 1936, of the mosquitos of Marajó Island, Brazil, where cases of jungle yellow fever had occurred in 1934 and 1935.

The following is from the authors' summary: Totals of 10,121 adult mosquitos and 1,260 larvae, representing some 80 species, were

taken. No examples of Aëdes aegypti, L., were found. The most common species that bit man by day in the forests were A. nubilus, Theo., Psorophora ferox, Humb., and Haemagogus janthinomys, Dyar. Lists are given of the other biting insects and ticks collected.

ROOT (F. M.). & ANDREWS (J.). Malaria and Anopheline Survey of Grenada, B.W.I.—Amer. J. Hyg. 27 no. 3 pp. 549-579, 1 fig., 5 maps, 15 refs. Baltimore, Md, May 1938.

This is an abridged account of investigations on malaria in Grenada, carried out in July-August 1929. The island, its climate and population are briefly described and an account is given of a spleen and parasite survey, and of an Anopheline survey undertaken by the senior author. Keys are given to the adults and larvae of the three species, Anopheles tarsimaculatus, Goeldi, A. pseudopunctipennis, Theo., and A. argyritarsis, R.-D., and their breeding places are discussed [cf. R.A.E., B 23 28]. From a survey of the literature on the susceptibility of these Anophelines to infection with malaria parasites, and a study of their distribution and that of the disease on the island, it is concluded that A. tarsimaculatus is probably the vector.

Coggeshall (L. T.). Plasmodium lophurae, a new Species of Malaria Parasite pathogenic for the domestic Fowl.—Amer. J. Hyg. 27 no. 3 pp. 615-618, 1 pl., 2 refs. Baltimore, Md, May 1938.

A description is given of Plasmodium lophurae, sp. n., which was isolated in New York in June 1937 from the blood of a fireback pheasant (Lophura igniti) from Borneo. This species of Plasmodium differs both in morphology and in pathogenicity from P. gallinaceum [cf. R.A.E., B 24 297] and from other species of Plasmodium commonly found in birds. It produces only very mild infections in adult domestic fowls and a moderately severe disease that does not, as a rule, terminate fatally in young chickens; it has been maintained in fowls for more than 8 months. Local varieties of pheasant have been found susceptible, but repeated attempts to transmit the disease to canaries have produced two light infections only, and pigeons have so far proved refractory. Of females of Aëdes aegypti, L., that had engorged on an infected chicken, 9 out of 15 dissected on the 6th day showed 2-15 oöcysts on the stomach wall, and 2 dissected at the end of a fortnight had infection in the salivary glands. Repeated attempts to infect Culex pipiens, L., failed, except in the case of one mosquito in which a few small oocysts were seen on the stomach wall. Anopheles quadrimaculatus, Say, and A. punctipennis, Say, did not become infected.

JOHNSON (E. P.), UNDERHILL (G. W.), COX (J. A.) & THRELKELD (W. L.). A Blood Protozoon of Turkeys transmitted by Simulium nigroparvum (Twinn).—Amer. J. Hyg. 27 no. 3 pp. 649–665, 3 pls., 13 refs. Baltimore, Md, May 1938.

The literature on the species of *Leucocytozoon* infesting various birds is reviewed. A disease attributed to *L. smithi* affecting turkeys in Nebraska and one attributed to *L. anatis* affecting domestic ducks and wild ducks in Michigan have been reported to be transmitted in the United States by *Simulium occidentale*, Ths., and *S. venustum*,

Say, respectively. A similar blood parasite appears to be the causal organism of a disease that has caused considerable mortality of turkeys in the south-western part of Virginia in recent years, usually during July and August. Investigations were undertaken to determine whether this parasite was also transmitted by insects. Two species of Simuliids have been found feeding on turkeys in Virginia, and other species may do so, but only one, Simulium nigroparum, Twinn, was observed to feed on them in abundance in the western part of the state. Groups of 20 or more Simuliids that had engorged on a "carrier" bird were macerated in normal saline and injected after varying intervals of time into 14 uninfected turkeys. Protozoa were seen in the blood of 8 of the birds 9–13 days after they had received injections of suspensions of groups that had fed 45–64 hours

previously.

In another experiment, two identical shelters were erected near a stream in which were placed an abundance of larvae and pupae of Simuliids that had been collected in streams near infected farms. One of the two shelters was made fly-proof with butter muslin having 24 by 28 strands per inch, and 26 turkeys 7 weeks old were placed in each about 1st June. Blood smears from the birds were examined at that time and at weekly intervals throughout the summer. After three weeks, during which all birds remained uninfected, two "carrier" turkeys were placed on a platform enclosed with ordinary chicken wire about 10 feet from the shelters. Three weeks later, 4 of the 26 birds in the unprotected shelter showed protozoa in their blood and before the summer had passed 18 had become infected, although all the birds in the fly-proof house remained free from parasites. In September, 6 of the uninfected birds were placed in a fly-proof cage in an animal house and the remaining ones outside in an open yard; the former all remained healthy, whereas 7 of the latter became infected. A similar experiment in which the shelter previously left open was enclosed with ordinary screen wire of 16 meshes to the inch showed that this did not prevent access of the flies, since 8 birds became infected during the summer, whereas all those in the house protected by muslin remained healthy. Moreover, 200 birds kept in houses protected by muslin in a locality where the disease had occurred in the previous year all remained uninfected; flies must have been present on this farm during the year, since several turkeys in a yard nearby showed protozoa in their blood about the middle of August. The stages of the parasite seen in the turkey and in the Simuliid are described and illustrated.

In Virginia, S. nigroparvum has been found breeding chiefly in the large creeks and rivers. Streams with flat rocky bottoms and a current of 4–5 ft. per second appear to be the most suitable; the larvae and pupae readily attach themselves to rocks, but were most numerous on submerged water willows (Dianthera americana). Pupae were first observed in the middle of April, larvae and pupae were most abundant during the middle and end of summer, and adults were numerous from late June to the end of August and were still plentiful during the greater part of September. The scarcity of cocoons and pupae in early November indicates that this is approximately the end of the season of emergence. Females appear to feed on turkeys from about the middle of May until the middle of October. They attached themselves securely in the region of the head and neck only, and are not easily disturbed until they have fully engorged. Quiet, warm, humid weather appeared to be most favourable for feeding. All

efforts to induce the flies to feed in captivity failed. They were taken feeding on turkeys at least 5–6 miles from the nearest known breeding place, although they were more abundant in the vicinity of their breeding places.

The control measures suggested consist in rearing birds in fly-proof houses and selling breeding turkeys as soon as the required number of eggs have been obtained and before the young birds are placed outside.

Examination of the blood of a number of wild birds gave negative results, but several wild turkeys reared in captivity were found to be "carriers" of a protozoon that appears to be identical with the one here described, and in parts of Virginia where wild turkeys are found they may serve as a reservoir of the disease.

Neveu-Lemaire (M.). **Traité d'entomologie médicale et vétérinaire.**Roy. 8vo, xxvii + 1339 pp., 597 figs., portr., 6 pp. refs. Paris, Vigot frères, 1938. Price Fr. 250.

The first part of this comprehensive treatise on medical and veterinary entomology deals in a general way with its importance and history, the types of parasites and their habits, their effect on their hosts and the reactions of the hosts to them, Arthropods that transmit pathogenic organisms and Helminths, parasites of Arthropods, venomous Arthropods, Arthropods as food, as therapeutic agents and in forensic medicine, their geographical distribution, methods of collecting, studying and rearing them, and, finally, their nomenclature and that of the infections they cause.

The second part, which is the most extensive (pp. 111-1213), comprises studies of the individual species concerned in the pathology of man or animals, giving notes on their synonymy, morphology, habitat, biology and geographical distribution, and the part they play

in pathology.

The third part is a list of parasitic and commensal Arthropods, arranged under the mammals, birds and insects (bees and silkworms) with which they are associated, and the fourth is a list of the parasites and pathogenic organisms of which Arthropods are the intermediate hosts or the vectors. Leeches are the subject of an appendix, and the work concludes with an index of 45 pages.

Stempell (W.). Die tierischen Parasiten des Menschen. [The Animal Parasites of Man.]—Roy. 8vo, viii+226 pp., over 220 figs., 4 pp. refs. Jena, Fischer, 1938. Price, paper M.12; bound $M.13\cdot50$.

This text-book is designed to facilitate the identification of the various animal parasites that attack man. Brief descriptions of the principal species are supplemented by numerous illustrations. The section on Arthropods, which comprises 42 pages, also includes notes on those that are important as vectors of disease. Some information on vectors is also given under the protozoa and other organisms that are transmitted by Arthropods.

Séguy (E.). La vie des mouches et des moustiques.—Cr. 8vo, 254 pp., 12 pls. (4 col.). Paris, Lib. Delagrave, 1938. Price Fr.16·00.

This book deals in a popular and general manner with the lifehistories and habits of the commoner flies and mosquitos that are in various ways injurious to man or domestic animals. Mackerras (M. J.). Losses due to the Sheep Blowfly.—J. Coun. sci. industr. Res. Aust. 11 no. 2 pp. 97-102, 21 refs. Melbourne, May 1938.

The author gives an account from the literature of the estimated losses that result from infestation of sheep by various species of blowflies in Great Britain, South Africa, New Zealand and, particularly, Australia.

Thomson (R. C. M.). The Reactions of Mosquitoes to Temperature and Humidity.—Bull. ent. Res. 29 pt. 2 pp. 125–140, 6 diagr., 18 refs. London, July 1938.

The following is substantially the author's summary: The reactions of Culex fatigans, Wied., to temperature were studied by means of a new type of temperature gradient apparatus based on the same principles as the humidity alternative chamber [described in a paper already noticed (R.A.E., A.25.56)]. Females at different stages were exposed to a range of 5°C. [9°F.] at different parts of the temperature scale, and it was found that sensitivity was very much greater at high temperatures than at low ones. The most striking feature of behaviour at all stages was the strong avoidance of high temperatures. This was strongest in the hungry females, less strong in blood-fed females and those with mature ovaries, and least strong in the newly emerged females. Newly emerged females showed avoidance of high temperature below 30°C. [86°F.], but not below 25°C. [77°F.]. They also showed a weak avoidance of low temperature. At 29°C. [84·2°F.], they were sensitive to a difference of 1°C. [1·8°F.] (which gave a gradient of 0.05°C. [0.09°F.] per cm.). Hungry females showed a strong avoidance of high temperature below 25°C., the reaction still taking place below 15°C. [59°F.]. There was no avoidance of low temperatures. Blood-fed females and those with mature ovaries showed a strong avoidance of high temperatures below 25°C., but below 20°C. [68°F.] they were unaffected by temperature differences. Blood-fed females were sensitive to a difference of 1°C. at 23°C. [73·4°F.]. Except in the case of newly emerged females, there was quite a close relation between the reactions to temperature and the effects of temperature. Reasons are given for regarding the temperature reactions of Culex as of the first importance in determining the behaviour of the mosquitos when seeking a resting place.

The reactions to humidity were studied by means of the alternative chamber, in a dark constant-temperature room at 25°C. during the daytime. At all stages, the strongest humidity reaction was an avoidance of high humidities above 95 per cent. R.H. This reaction was strongest in the blood-fed females and those with mature ovaries, less strong in the newly emerged females, and weakest in the hungry females. The avoidance of high humidity was strongest when there was a difference of 20 per cent. R.H., such as a 78–98 per cent. R.H. gradient. Near saturation point, all stages except hungry females were sensitive to a difference of 1 per cent. R.H. (or a gradient of 0·05 per cent. R.H. per cm.). Hungry females at this point were not sensitive to a difference of less than 3 per cent. R.H. All stages showed a slight but regular avoidance of low humidities, provided that a sufficiently large humidity range, not less than 40 per cent. R.H., was present. Hungry females, despite the onset of mortality due to desiccation, showed no

sharp avoidance of low humidities that were rapidly fatal to them. Between 30 and 85 per cent. R.H., all stages were unaffected by humidity differences of as much as 40 per cent. R.H. The avoidance of high humidities was equally strong in blood-fed females at 20, 25, and 30°C. At 35°C. [95°F.], greatly increased activity eliminated the reaction. The reaction was much less intense in daylight and disappeared altogether after sundown. Reasons are given for considering that the measure of humidity that determines the behaviour of the mosquito is relative humidity and not saturation deficiency, even though the latter is the important one in the water relations of insects.

MacLeod (J.). On the Protection of Sheep from Maggot-fly.—Bull. ent. Res. 29 pt. 2 pp. 149-163, 1 diagr., 6 refs. London, July 1938.

The author points out that the inability of workers to appreciate fully the difficulties involved in the satisfactory testing of methods for the control of blowflies attacking sheep in Great Britain has led to the publication of unreliable results and of general statements that cannot be supported by experimental evidence. In the ordinary type of field test, the fly incidence may be too low for significant results to be obtained when comparing small groups of control and treated sheep over short periods of time. Over longer periods, the difficulty of keeping the treated and control groups under exactly similar conditions must be taken into account, and the necessity for calculating the exact proportion of infested to uninfested sheep must be realised in estimating the significance of results where the control group of sheep is larger than the treated group. Even where the groups are small enough to be kept under identical conditions, sheep are not equally susceptible, and even if their susceptibility were capable of being controlled, the incidence of "strike" (myiasis), which is entirely dependent on the physical conditions in the fleece, would not be an index of the degree of "blow" (the deposition of eggs on the fleece), the occurrence of which is determined by the presence on the sheep of some source of attractive odours and by weather conditions that control fly activity. The term susceptibility should be used only for that condition that results in sheep being blown. Strike incidence is less an index of fly activity than of climate, especially micro-climate.

Chemical methods of control may be used to prevent blow by the use of repellents or the neutralisation of attractive odours, to destroy eggs by the use of ovicides or by rendering moisture conditions in the fleece unsuitable for the survival of the eggs, and to prevent strike by the use of larvicides or by rendering moisture conditions in the fleece unsuitable for the survival of larvae. The action of a dip or spray may be toxic, repellent or antiseptic. An antiseptic action is one that inhibits bacterial activity, and of the antiseptics in general use only the phenolic dips are considered worth discussing. The action of a repellent is due to the volatile constituents, which are sensed as odours by the fly and deter it from ovipositing. The toxicity, in the case of all preparations in common use, refers solely to their action on eggs or larvae; no study of the toxic effect of any substance on the flies that visit the fleece has yet been undertaken. In so far as British breeds of sheep are concerned, susceptibility of an individual is seldom constant, and in a given flock different individuals become susceptible at different times according to chance external or individual

circumstances, the susceptibility being transient or remaining constant according to the nature of the exciting circumstance. Thus a protective dressing should last for some time if it is to do more than protect the few sheep that happen to be susceptible at the time of application. Antiseptics of the phenolic group exert their principal influence at the time of application and are rapidly neutralised by organic matter, so that they have only a limited protective value. A repellent affords active instead of passive protection and should have greater potentialities, but its effect may be temporarily overcome at any time by the development of a strong attraction. Toxic chemicals, if they last in effective strength in the fleece for some length of time, should be the ideal protective dressings, since they would not only protect the sheep but also reduce the fly population. Moreover, they still exercise their protection under such conditions as the accidental soiling of the fleece, the use of foul dip, and increased susceptibility through water rot or excessive suint secretion and related bacterial activity, which would

render antiseptics and repellents useless.

Tests of the antiseptic property of a dip or spray must rely upon the natural incidence of strike, since the use of artificial "attractants" or the experimental production of strike would vitiate them. Thus, to be adequate, they must be carried out on a large and costly scale. The properties of an actively protective dip or spray may be repellent, ovicidal or larvicidal or a combination of them, and each property should be tested separately. Repellent action can be tested, even on a small number of sheep, if they are all made susceptible at one time by applying ammonium carbonate or indole to the fleece [cf. R.A.E., B 25 52]. The presence and duration of a larvicidal property may be precisely determined on a small number of sheep by producing strike artificially [cf. 26 25], the attempts to induce strike on treated animals being repeated at regular intervals until success is obtained. The testing of an ovicidal property is less independent of chance, but tolerably good results may sometimes be obtained by making a group of treated and a group of control sheep attractive by means of ammonium carbonate or indole and keeping those treated sheep that become blown with blown controls. If the control sheep develop strikes, absence of strike on treated sheep may be regarded as significant. The chief objection to this method is that it cannot be applied to dips that have a marked repellent property.

By using the methods outlined, it has been possible to obtain surprisingly precise quantitative data on the relative merits and potentialities of different chemicals and different preparations in common use for blowfly control. Not only may dips and sprays be biologically standardised, but preparations to meet given requirements may be rationally synthesised. The limitations of these methods are briefly mentioned, and the desirability of supplementing them by large scale field experiments under natural conditions is emphasised.

The inadvisability of relying on field tests only is stressed.

An account is given of experiments carried out to determine the value of three typical proprietary dips in protecting sheep from blow and strike on the body subsequent to dipping. Since the action of dips against blow or strike existing at the time of dipping is not necessarily the same, it has been made the subject of a separate investigation. The first dip was a standard arsenic-sulphur paste dip containing oleum picis (pine-tar oil) as a repellent, the second was an arsenic-sulphur powder dip and the third a coal-tar creosote (carbolic)

dip. Tests were also made to determine whether, as is frequently reported [cf. 25 283], water-soluble arsenic dips are rapidly washed out of the fleece by rain. The results obtained suggest the following conclusions: Carbolic dips neither repel the adult fly nor prevent larvae from establishing strike on the skin. Arsenic remains in the fleece and continues to exercise a protective effect against development of strike for some weeks after application; the protection may be partial or almost complete; under winter conditions it lasts about 4 weeks, and in the case of one form of soluble arsenic at least, it has been shown to be only slightly affected by heavy rain. Although spraying is the ideal method for applying a repellent, it cannot be regarded as suitable for larvicides, since it coats only the outer part of the wool staple and does not thoroughly saturate the fleece down to the skin surface. Larvicides should be applied by actual immersion.

THEODOR (O.). **On African Sandflies. III.**—Bull. ent. Res. **29** pt. 2 pp. 165–173, 7 figs., 4 refs. London, July 1938.

As a result of the examination of several collections, the author gives records of the distribution in Africa of a number of sandflies and notes on the characters of some. Adults of both sexes of *Phlebotomus thomsoni*, sp. n., from Nyasaland, and *P. matadiensis*, sp. n., from the Belgian Congo, are described, as are also the distinguishing characters of *P. squamipleuris* var. *inermis*, n., from Nigeria. A male of *P. langeroni*, Nitzu., was found in a collection made in El Fasher, Anglo-Egyptian Sudan, in May 1934; this is the first record of a sandfly of the group of *P. major*, Annan., from a kala-azar region in this country.

Golding (F. D.). Notes on Blood-sucking Flies in the Ilorin Province, Nigeria.—Bull. ent. Res. 29 pt. 2 pp. 215-218, 1 diagr., 2 refs. London, July 1938.

Three tsetse-fly surveys were carried out in 22 localities in Ilorin Province, Nigeria, in 1937, and the results are compared with those obtained in a survey by Macfie in 1912 [cf. R.A.E., B 1 137]. During 1937, only 4 examples of Glossina tachinoides, Westw., and one of G. morsitans submorsitans, Newst., were observed, and it seems probable that the latter, which was caught about 10 yards from a trade route, had followed cattle from areas north of the Niger, where game is abundant and conditions are more favourable. G. palpalis, R.-D., was taken in all but one of the localities. The apparent absence of G. m. submorsitans from the Zambufu-Lafiagi area in 1937 is of interest, for in recent years Fulani cattle have been grazing during the rains, and in some cases throughout the year, in areas far to the east of those shown on Macfie's map [cf. loc. cit.]. There is now a motor road through Zambufu, and it is certain that antelope are far less common than they were even 15 years ago. In 1912, G. palpalis and G. tachinoides apparently occurred in about equal proportions in the eastern and western divisions of the Province, but in 1937, out of 70 flies caught in 13 localities in the old western division, 66 were G. palpalis and 4 G. tachinoides, and 31 flies caught in the vicinity of Ilorin in December 1936 were all G. palpalis. It is certain that the alteration in the proportion of these two flies that has occurred in the old western division during the last 25 years is not due to an increase in the numbers of *G. palpalis*. It is possible that changes in ecological conditions due to the opening up of the country have been more inimical to *G. tachinoides* than to *G. palpalis*; probably the reduction in the numbers of antelope is the most marked change that has occurred. Of 47 flies collected in 12 localities, more than half belonged to the small race described by Macfie.

Records are also given of Tabanids and other blood-sucking flies

found during the surveys.

Guibert (J. M.). Verpuppungsdauer von Glossina palpalis. [The Duration of the Pupal Period of G. palpalis.]—Arch. Schiffs-u. Tropenhyg. 42 pt. 6 p. 265, 1 fig. Leipzig, 1938.

A pupal period of 31 days is recorded for a single pupa of *Glossina palpalis*, R.-D., found in a cage containing adults that had been caught in the French Cameroons and fed on guineapigs. The temperature was 20–30°C. [68–86°F.] and the air humidity 65–88 per cent.

CAMPBELL (J. McP.). An Outbreak of Plague in Mwanza, February to June, 1937.—J. trop. Med. Hyg. 41 no. 10 pp. 157-167, 1 fig., 3 graphs. London, 16th May 1938.

A detailed account is given of an outbreak of plague that occurred in Mwanza, Tanganyika Territory, between February and June 1937, and of the measures taken for its control. A batch of fleas from this locality examined in 1935 included 146 examples of Xenopsylla cheopis, Roths., 41 of X. brasiliensis, Baker, and 164 of Echidnophaga gallinacea, Westw. A preliminary survey carried out at the end of the outbreak (26th June-23rd July) revealed the same species of fleas, but also showed that, even among rats trapped alive, there was a large number that harboured no fleas. A more careful survey was carried out on rats caught alive between the beginning of November and the end of January 1938, and the results are shown in a table. In December, when climatic conditions were similar to those at the time of the outbreak, X. cheopis was becoming the most prevalent flea on rats. It has been suggested that rat destruction, other than that brought about by plague infection (which affects both rats and fleas), interferes with the proper balance between rats and fleas and, since a shortage of rats may induce fleas to seek other hosts, it may tend to increase the spread of plague in man. In Mwanza, however, plague disappeared from the centre of the town, where rats had been most reduced in numbers, while it still continued on the outskirts, where rats were most numerous.

There is definite evidence that the outbreak was started by infected fleas carried in hides from an endemic rural area to the town. Cases occurred among persons that had come into contact with such hides and later infected rats were found. All the plague-infected rats found were Mus (Rattus) rattus. There are good grounds for believing that field rats are not driven into town dwellings by rain, and that, when rats desert plague-infected dwellings, they do not go far and soon return. The part played by rat fleas in infecting man was demonstrated by a

case in a European who visited a warehouse, in which dead plague-infected rats had been found, before any precautionary measure had been applied. Three fleas were found on his body half-an-hour after he left the warehouse, and he developed plague three days later. An insecticidal emulsion was sprayed in front of other workers entering infected premises, their legs and arms were also sprayed, and none of them contracted plague. The advisability of supplying the African staff with overalls and knee-boots is considered doubtful, since it might lead them to neglect other precautions, fleas might be collected and distributed, and there would also be some risk of workers being

bitten in the changing room. Infected fleas may be carried to a town from rural areas in unpressed hides or raw seed-cotton, but not in pressed hides, cotton-seed or baled cotton lint. Hides dried but unpressed are stored in native huts. In the proper preparation of hides baled for export, they are laid one by one in a press and naphthalene powder is sprinkled between them to prevent damage by insects; they are then pressed and the bale tightly bound, so that there is little danger of fleas being carried among them. Cotton-seed is taken from factories to huts and planted, or it is exported from the factories, but it is not taken from huts to factories. In the course of ginning and baling, cotton lint goes through processes that no fleas can survive. Raw seed-cotton is, however, stored in huts, taken to produce markets and thence to ginneries, and although the seed is not attractive to rats as food [cf. R.A.E., B 22 170], the author has frequently observed rats' nests in stored cotton; there is, therefore, the danger of infected fleas being carried from hut to ginnery. This danger cannot be avoided, but such seed-cotton should be stored in rat-proof warehouses prior to ginning to minimise the risk of the factory rats becoming infected.

Only one climatic factor coincided fairly accurately in time with the outbreak; the relative humidity was steadily above 80 per cent. from 20 days before the outbreak started until 14 days before it ceased. The prevention of recurrence is being attempted by controlling the importation and storage of material attractive to rats from rural areas where plague is endemic, and by endeavouring to exterminate rats in and near former plague foci during the off-season, since these are most likely to be plague carriers. The author considers it more important to destroy rats during the off-season than during an epidemic; during an epidemic, rats replacing those killed will be liable to become infected from fleas in the burrows, whereas during the off-season, when plague is not transmissible, the fresh rats cannot contract the disease, which may then die out. It is also believed that such measures might be

effective in rural endemic areas where plague is seasonal.

Stella (E.). Gli Ixodidi dell'Africa Orientale Italiana. [The Ticks of Italian East Africa.]—Riv. Biol. colon. 1 fasc. 2 pp. 135–153, 4 figs., 3 pp. refs. Rome, April 1938. (With Summaries in French, English and German.)

The author gives a brief account from the literature of the ticks that have been recorded in the 6 administrative divisions of Italian East Africa and in British and French Somaliland, together with notes on their hosts and on the diseases they may transmit to man and domestic animals, and a key to their genera.

[Elpat'evskii (V. S.).] Еппатьевский (В. С.). Beobachtungen an Rhipicephalus sanguineus Latr. in der Stadt Baku. [Observations on R. sanguineus in the town of Baku.] [In Russian.]—Trud. Azerbaij. Fil. Akad. Nauk USSR 7 (Sekt. Zool.) pp. 127-130, 1 graph. Baku, 1934. (With a Summary in German.) [Recd. July 1938.]

Rhipicephalus sanguineus, Latr., is abundant in summer on dogs in the town of Baku (Azerbaijan), and has also been taken on horses. cattle, sheep and goats. It was the only tick found on a dog kept in the town from 24th February till the beginning of November and examined almost daily. The ticks appeared in March and disappeared in October, but were found on the dog throughout the intervening period. They showed two peaks of abundance, in May, when almost all of them were adults, and in July, when most of them were nymphs. Apparently, the nymphs hibernate and thus there is one generation a year; under room conditions, those that dropped from the dog transformed into adults about the middle of January, but none did so in the autumn. In nature the last moult probably occurs in spring. No larvae were found either on the dog or in the field, and attempts to rear them from the eggs were unsuccessful. In nature, engorged females and nymphs occurred in cracks in the stone steps leading to the house.

PEUS (F.). **Die Flohplage und ihre Bekämpfung.** [The Flea Pest and its Control.] — Z. hyg. Zool. SchädlBekämpf. **30** pt. 5 pp. 129–142, 2 figs., 1 ref. Berlin, May 1938.

In Germany, where over fifty species of fleas occur, man is attacked by *Pulex irritans*, L., and five others, of which the main hosts are domestic animals or birds. Characters distinguishing these species and a brief account of the bionomics and control of fleas are given.

HIRSCHFELDER (H.) & WOLF (J.). **Die Bedeutung von Insekten und Zecken für die Epidemiologie der Maul- und Klauenseuche.** [The Importance of Insects and Ticks for the Epidemiology of Footand-mouth Disease.]—Z. hyg. Zool SchädlBekämpf. **30** pt. 5 pp. 142–147, 18 refs. Berlin, May 1938.

From a review of the literature on the question, the authors conclude that insects and ticks can play only a very subordinate part in the diffusion of foot-and-mouth disease. They observed on the infected island of Riems, about half a mile off the coast of Pomerania, that flies sought shelter from wind, and point out that for many years no case of the disease has occurred among cattle along the Pomeranian coast, although the frequent north-west wind might be expected to carry the flies, and, consequently, any virus harboured by them, to the mainland.

Knipling (E. F.). Internal Treatment of Animals with Phenothiazine to prevent Development of Horn Fly Larvae in Manure.—*J. econ. Ent.* 31 no. 2 pp. 315–316. Menasha, Wis., April 1938.

The following is substantially the author's summary: In three experiments, which are described, phenothiazine [thiodiphenylamine] administered to cattle at the rate of approximately $0.1~\mathrm{gm}$. or less per kilogram of body-weight prevented development of larvae of the horn fly, Lyperosia (Haematobia) irritans, L., in dung excreted by them.

CIUREA (I.), SÉGUY (E.) & STEFANESCU (T.). Sur une espèce de taon (Sziladynus solstitialis var. ciureai, nov. Séguy 1937) qui attaque impétueusement l'homme et les animaux dans le delta du Danube.—Arch. roum. Path. exp. Microbiol. 10 no. 3 pp. 205-210, 3 pls. (1 col.). Paris, September 1937. [Recd. 1938.]

Sziladynus solstitialis var. ciureai, n., which is here described from the female by Séguy, occurs in large numbers in the delta region of the Danube (Rumania), where it attacks both man and animals. The adults occur from the beginning of June until the end of August, when the cold rains cause their disappearance. They are more numerous in dry years than in wet ones and bite only when the sun is shining. Animals are maddened by the sudden attacks of swarms of these flies, and those that are harnessed may break away to plunge into water or to seek shelter among the reeds. They can feed only during a few hours in the morning and in the evening until mosquitoes appear, so that they become thin during the summer months and the milk yield of cows is considerably reduced. Small tumours are produced at the site of the bites, but these disappear in two or three days.

Cernaianu (C.). Piroplasmes et piroplasmoses des animaux domestiques en Roumanie.—Arch. roum. Path. exp. Microbiol. 10 no. 3 pp. 281–293, 3 pls., 1 map., 24 refs. Paris, September 1937. [Recd. 1938.]

Piroplasms found in the blood of cattle in Rumania comprise Piroplasma bovis, which is transmitted by Ixodes ricinus, L., P. bigeminum, which is transmitted by Boophilus (Margaropus) calcaratus, Bir., P. berbera (Françaiella caucasica), which was first observed in April 1936, and P. (Babesiella) major, which was first observed in 1937 in the blood of cattle on which the only ticks found were of the genus Ixodes. All these piroplasms are described and notes are given on the symptoms and treatment of the diseases caused by the first two. The cases of piroplasmosis observed north of Lat. 45° were all due to P. bovis. P. bigeminum only occurs in southern Rumania up to this latitude, which is the limit of the distribution of ticks of the genus Boophilus (Margaropus).

BLEWITT (B.). Fevers of the Typhus Group in the Bhim Tal Area, Kumaun Hills, U.P., India. Being a Report of an Investigation carried out into the alleged Incidence and Nature of Typhus Group Fevers in the Bhim Tal Area, Kumaun Hills, July, 1936.—J. roy. Army med. Cps 70 nos. 3-6 pp. 57-167, 241-245, 312-315, 379-387, 1 map, 6 charts, 30 refs. London, 1938.

In view of the suggestion that tick-borne typhus was present in the Bhim Tal area in the Kumaun Hills [cf. R.A.E., B 9 214; 13 66], a prejudice arose against the valley and its immediate environs out of all proportion to the incidence of the fevers that were thought to have been contracted there. During July 1936, collections of ticks were made in the Bhim Tal valley, the Malwa Tal area, and the surrounding forest jungles, the area covered being approximately 50 square miles. Drives with a front of 400 yards were made from end to end of the area, ticks were collected from all cattle and other animals encountered, from coarse white cloths or flags dragged by the coolies over the vegetation, and from large numbers of dogs, which were freed from

ticks at the end of each drive. Some thousands of ticks were taken, but only 1,000 made up of a selected number from each zone were retained for experiment. At least 60 per cent. were either Rhipicephalus sanguineus, Latr., or Hyalomma savignyi, Gerv. (aegyptium, auct.). Some of the ticks were emulsified and injected intraperitoneally into laboratory animals (guineapigs, rabbits, rats and mice); others were allowed to feed for 3-4 days on laboratory animals and then emulsified and injected intraperitoneally into their hosts, when presumably a re-activated virus would be introduced if it were present in the ticks. In all, 26 animals were used and 814 ticks. There was nothing in the reactions of the animals to suggest that they had acquired the typhus virus, and in no case was any organism resembling rickettsiae observed. In a more recent study it was found impossible to infect R. sanguineus and H. savignyi with the Indian virus.

The evidence for and against the theory that the typhus of the region is tick-borne is carefully reviewed. Typhus carried by lice [Pediculus humanus, L.] has apparently always been endemic among the hill people of the Kumaun. The author considers that the cases reported by McKechnie in 1913 [cf. 9 214] were louse-borne typhus and that his conclusion that Europeans contract it from contact with natives is probably correct. Cases that have occurred since that time do not differ clinically and differ epidemiologically only in the absence of a recorded epidemic among natives in association with them. It is apparently characteristic of epidemics in the hills that they are usually confined to one or more huts and rarely assume major proportions. Thus, it is not improbable that minor typhus epidemics have occurred and passed unnoticed; sporadic cases among natives have been recorded and one fatal case in a European has been definitely associated with the disease in a native. Of the 177 cases recorded between 1913 and 1936 [cf. 24 91], only 16 had a recorded history of tick-bite prior to the onset of the disease, only one of these came from the Kumaun Hills, and the man in question had been in contact with a louse-infested population. Topographically the region resembles that in which the tick-borne Rocky Mountain spotted fever occurs, but the analogy is not supported by local evidence nor by that from other parts of India. Although analogy suggests that more than one form of typhus may exist in this region, there is no evidence on which to establish a prima facie case against any insect other than the louse.

Chung (Huei-Lan) & Chang (J. H. M.). Studies on the Etiology of Typhus Fever in North China.—Chin. med. J. 53 no. 6 pp. 513–538, 4 pls., 2 figs., 28 refs. Peking, June 1938.

Details are given of a case of typhus that occurred in north China and of numerous experiments, including some with lice [Pediculus humanus, L.], carried out to determine the exact nature of the infection. Lice from the patient's garments contained rickettsiae morphologically indistinguishable from Rickettsiae provazeki and, when emulsified and injected into guineapigs, induced typical fever after a certain incubation period. Laboratory-bred lice containing no rickettsiae became heavily infected with rickettsiae after being fed for some days on the patient during his febrile period, and emulsions of these lice induced typical febrile reactions in guineapigs. Emulsions of the brains of infected guineapigs injected intrarectally into normal lice induced rapid and luxuriant growth of rickettsiae in the intestines

of the lice, and these lice when emulsified and injected into guineapigs produced typical fever after an incubation period of only 3 days. From the results of these and the other experiments, it is concluded that a pathogenic rickettsia biologically and morphologically indistinguishable from *Rickettsia prowazeki* is a cause of typhus fever in north China and that lice are the vectors.

Jackson (R. B.). A Guide to the Identification of the Anopheline Mosquitoes of the Colony of Hong Kong with Notes concerning them.—Chin. med. J. 53 no. 6 pp. 563-576, 18 figs., 2 refs. Peking, June 1938.

After a brief account of the morphology of an adult mosquito, the characters by which the tribe Anophelini may be distinguished, and the methods of obtaining and examining specimens of adult Anophelines, the author gives a list of the 10 species of *Anopheles* recorded from Hong Kong and discusses the habits of the adults and their relation to malaria and filariasis [cf. R.A.E., B 25 97]. A key to the adults is appended.

BAISAS (F. E.) & Hu (S. M. K.). Anopheles hyrcanus var. sinensis of the Philippines and certain parts of China, with some Comments on Anopheles hyrcanus var. nigerrimus of the Philippines.—Mon. Bull. Bur. Hlth Philipp. 16 no. 6 pp. 205-242, 6 pls., 2 figs., 52 refs. Manila, June 1936. [Recd. September 1938.]

Since Anopheles hyrcanus var. sinensis, Wied., appears to be concerned in the transmission of malaria in some places and not in others, the question of the homogeneity of the subspecies has been raised, and the results of a preliminary study of the forms of A. hyrcanus, Pall., in the Far East are given in the present paper. Eggs from Shanghai, Hangchow, Hong Kong, Tonkin and the Philippines were examined. The main character that differentiates the eggs of one form of the sinensis-group from another is the width of the deck or dorsal surface, which may be about one-tenth, one-fifth or one-half the width of the entire egg. The wide-decked variety that appears to be present in Japan, China, Indo-China, Malaya, Borneo and Sumatra, but not in the Philippines, is assumed to be the true var. sinensis and the one responsible for the transmission of malaria in The narrow-decked variety that is found in the Philippines and was previously considered to be var. sinensis [R.A.E. B 25 29] is raised to varietal rank and named var. lesteri, n. Var. pseudosinensis, Baisas, the egg of which has a deck that is intermediate in size, has so far been found only in the Philippines [cf. loc. cit.], although the characters of a pupal skin from Malaya indicate its presence there also. Brief descriptions of the eggs show the other characters distinguishing the varieties. The eggs of var. nigerrimus, Giles, also have narrow decks and are indistinguishable from those of var. lesteri, although the two varieties are easily separable in the larval, pupal and adult stages. The characters distinguishing the larvae, pupae and adults of the members of the sinensis group are discussed; var. pseudosinensis and var. lesteri are readily distinguishable in the egg and pupal stages, but not in the larval and adult stages; the differential characters found in the larval and pupal stages of these two varieties are found intermixed in the corresponding stages of material

from China, which is assumed to be the true var. sinensis. It is also assumed that the Chinese variety having narrow-decked eggs, such as those described by Yao and Wu [26 125], is identical with var. lesteri. The wings of the varieties, including those of var. sinensis from Hangchow, Tsing-Kiang-Pu, Hong Kong, Tonkin and Singapore are described; the wings of var. sinensis become paler in the more northern latitudes. It is suggested that should the characters of the eggs and adults corroborate the peculiarities of the larvae and pupae of a form from Penang (Malaya), the name var. williamsoni should be applied to it.

URBINO (C. M.). The Eggs of some Philippine Anopheles.—Mon. Bull. Bur. Hlth Philipp. 16 no. 7 pp. 261-273, 6 pls., 1 fig., 18 refs. Manila, July 1936. [Recd. September 1938.]

After giving notes on the structure of Anopheline eggs, the author describes those of Anopheles barbirostris, Wulp (three types), A. hyrcanus var. sinensis, Wied. (var. lesteri, Baisas & Hu [cf. preceding paper]), which cannot be distinguished from that of A. hyrcanus var. nigerrimus, Giles, A. pseudobarbirostris, Ludl., A. minimus var. flavirostris, Ludl., A. filipinae, Mnlg., A. mangyanus, Banks, A. vagus var. limosus, King, A. ludlowi, Theo., A. litoralis, King, A. subpictus var. indefinitus, Ludl. (3 types), A. maculatus, Theo., A. karwari, James, A. annularis, Wulp, A. philippinensis, Ludl., A. kochi, Dön., and A. tessellatus, Theo., and gives a key for their separation.

COLAS-BELCOUR (J.). Note sur Trypanosoma viennei Lavier 1921=Tr. guyanense Leger et Vienne 1919.—Bull. Soc. Path. exot. 31 no. 5 pp. 369-374, 1 graph, 11 refs. Paris, 1938.

ROUBAUD (E.), COLAS-BELCOUR (J.) & GASCHEN (H.). Le trypanosome des Antilles, Trypanosoma viennei a-t-il perdu l'aptitude à évoluer

chez les glossines ?—T.c. pp. 374-377, 5 refs.

MESNIL (F.), PÉRARD (C.) & PROVOST (A.). Recherches expérimentales sur un trypanosome des ruminants de Martinique.—T.c. pp. 377-381, 1 fig., 3 refs.

Trypanosoma viennei (guyanense, Leger & Vienne, nec Mesnil), occurs in cattle in French Guiana [R.A.E., B 7 137], Venezuela [8 147], Guadaloupe, where it was identified by Mesnil as belonging to the type of T. vivax (cazalboui) [15 214], and Martinique. In the first paper, the author discusses the results obtained from comparing a strain of this trypanosome, received from Martinique in a sheep, with living and dead examples of T. vivax; and concludes that they are similar morphologically. In the second paper, details are given of experiments in which examples of Glossina palpalis, R.-D., and G. tachinoides, Westw., were fed repeatedly on sheep or kids infected with T. viennei. Subsequent dissections at intervals revealed no trypanosomes in the flies. It is concluded that T. viennei may be a form of T. vivax that, occurring in countries where Glossina does not exist, has lost the power of cyclical development. In the third paper are given the results of experiments in which the strain of T. viennei brought from Martinique was inoculated into laboratory animals and into two sheep, two kids and a horse. The trypanosome resembled T. vivax in that negative results were obtained with the laboratory animals, but the comparative mildness of the disease in sheep and the light and fugitive infection obtained with difficulty in the horse indicate that it is not identical with $T.\ vivax$, which causes a frequent, serious and often fatal disease in horses in Africa.

Lefebure (M.). Recherches sur la faune anophélienne au Laos.—
Bull. Soc. Path. exot. 31 no. 5 pp. 381-386. Paris, 1938.

A. minimus, vecteur principal du paludisme au Laos.—T.c.
pp. 387-390.

In the first paper, an account is given of an Anopheline survey carried out in Laos from April 1936 to March 1937, in the course of which 4,796 adults and 2,320 larvae belonging to 17 species were examined. Within the region are certain well-defined areas with definite physiographical characters, namely, the wooded or cultivated plains bordering the Mekong (average altitude 660 ft.), forest-covered plains (800 ft.), terraced rice-fields with artificial irrigation (1,150 ft.), calcareous mountains with plateaux and deep valleys (1,300-3,940 ft.) and the high mountains of Haut Laos (4,260-5,900 ft.), each of which has a characteristic Anopheline fauna. Anopheles vagus, Dön., is ubiquitous and by far the most abundant species. A. minimus, Theo., which is next in abundance and the principal malaria vector [cf. R.A.E., B 22 219], breeds most frequently in clear waters in the hilly regions of average altitude (up to 4,900 ft.). A. barbirostris, Wulp, which is almost as numerous as A. minimus, appears to be the typical species of the thickly-wooded plains bordering the Mekong. A. maculatus, Theo., and A. jeyporiensis, James (most examples of which were var. candidiensis, Koidz.), which are also considered to be vectors, are less numerous and appear to be scarce in the valley of the Mekong; the former prefers the sunny slopes of mountains cleared of forest, and the latter high altitudes. A. culicifacies, Giles, an important vector in India and Ceylon, seems to be rare. A. leucosphyrus, Dön., comprised 56 per cent. of the Anophelines collected in the forest-covered plains, but almost all the examples were taken during the rainy season (June-October); it is strongly suspected of being a vector. The Anopheline fauna increased both in number and species in May, June and July, that is, at the beginning of the rainy season, so that this period is particularly dangerous from the point of view of malaria.

In the second paper, the author discusses the relation between the Anopheline fauna and the incidence of malaria. Wherever A. minimus occurs the disease is serious; although other vectors may exist in the same localities, their numbers may be very small in comparison. Certain localities in which A. minimus is not found are almost free from infection, but there are others in which the disease is endemic and its transmission is due to secondary vectors. Although A. minimus usually breeds in clear, well-aerated water or rivers with a rapid current, the larvae may be found in stagnant water, or even buffalo wallows in regions where it is abundant, and it is probably this ability to adapt itself that enables it to persist throughout the year and to multiply as soon as the rains begin and that accounts for the constancy of endemic malaria in these places. Dissection of 37 females of this species from one village at the beginning of the rainy season revealed two infected with sporozoites. The preferred breeding places of A. minimus are found throughout the mountain massif of Haut Laos and on the slopes of the Annamitic Chain in

Moyen and Bas-Laos, so that it is present over the greater part of the country. The secondary vectors in particular areas would appear to be A. maculatus in the rice-field area on the mountain slopes and at high altitudes, A. jeyporiensis in the high valleys of Haut Laos, where the climate is cold, and probably A. leucosphyrus in the wooded plains in the valley of the Mekong, where 2 out of 29 females of this species were found to contain oöcysts. The sites where A. minimus is present are characterised by constant hyperendemic malaria, whereas those where transmission is due to other species show a seasonal recurrence of the disease at the beginning of the rains.

Farinaud (E.). Sur la présence en Indochine méridionale d'une espèce anophélienne sylvatique A. annandalei.—Bull. Soc. Path. exot. 31 no. 5 pp. 390-393, 1 fig., 4 refs. Paris, 1938.

A description is given of a female of Anopheles annandalei, Prashad, var. interruptus, Puri, that was taken in Cambodia in a native hut in a plantation immediately adjoining a forest at an altitude of about 300 ft. A. annandalei had not before been taken in Indo-China or in dwellings; in Java and India, it usually occurs at altitudes between 3,000 and 5,000 ft. It belongs to a group of forest mosquitos that breed in tree-holes and do not generally bite man.

FARINAUD (E.). Note préliminaire sur la présence en Indochine méridionale de A. baezai (Gater).—Bull. Soc. Path. exot. 31 no. 5 pp. 393-397, 2 figs. Paris, 1938.

The author describes the adult and larvae of an Anopheline taken in Cochin China that he considers to be *Anopheles baezai*, Gater, a species not hitherto recorded from Indo-China. The larvae, from which the adult was bred, were taken in pools of stagnant, definitely brackish water, containing much vegetable matter [cf. R.A.E., B 22 103]. It has been suggested that A. baezai is concerned in the transmission of malaria in Malaya [loc. cit.] and, since the larvae were collected at the time of an outbreak of the disease, it may also be a vector in Cochin China, although its rarity would prevent its being of any great importance.

FARINAUD (E.). Données récentes sur la transmission du paludisme dans les régions maritimes d'Indochine méridionale.—Bull. Soc. Path. exot. 31 no. 5 pp. 397-401. Paris, 1938.

Although in comparison with the high regions of Indo-China, where malaria is hyperendemic, the delta regions are generally considered healthy, they are nevertheless subject to outbreaks that are often serious. The type of malaria is, however, better tolerated by the people, the more serious forms are rare, the mortality is low, and children are numerous, whereas the native races in the interior of the country are gradually dying out. The relative healthiness of the maritime regions is due to the fact that *Anopheles minimus*, Theo., and *A. jeyporiensis*, James, the two chief vectors in Indo-China, are almost completely absent. For this reason, vectors were sought among the Anopheline fauna of brackish waters, of which *A. sundaicus*, Rdnw., and *A. subpictus*, Grassi, are the most numerous in Indo-China. Anopheline surveys were carried out in 1937 in three localities in Cochin China immediately following the onset of malaria epidemics. In all

these localities, in which there were pools, rice-fields or lagoons of brackish water, A. vagus, Dön., constituted 70-80 per cent. of the fauna and A. minimus was absent or rare. In each case the epidemics, which occurred in June-July, November, and December, respectively, coincided with a definite increase in the numbers of certain species. In the first case these were A. subpictus, A. sundaicus, and A. leucosphyrus, Dön., and in the second and third A. sundaicus only, the percentages harbouring malaria parasites being 2, 4.41 and 2, 5.55 and 4.16, respectively, and the numbers dissected 50, 68 and 50, 126 and 47. From this the author concludes that the rate of infection may be related to the intensity of multiplication, since in the first case the rate was lower in A. sundaicus than in A. subpictus, which increased to a greater extent. A. leucosphyrus is probably an accidental vector, but its infection also coincided with an abnormal multiplication. The increases of Anophelines are of short duration. In one locality 125 examples of A. sundaicus were found in November, 10 in December and only 2 in February, and in another 47 were found towards the end of December, and the species had disappeared entirely by the beginning of February. Under natural conditions, the longevity of this species does not appear to be great. This confirms the opinion that the species that are capable of rapid multiplication are those in which life is shortest, and also corresponds with the seasonal character of the malaria outbreaks, which vary in intensity and extent from one vear to another.

Toumanoff (C.). Arguments nouveaux en faveur du comportement racial de A. hyrcanus var. sinensis Wied. au Tonkin.—Bull. Soc. Path. exot. 31 no. 5 pp. 401–406, 10 refs. Paris, 1938.

The author discusses the question of the occurrence of races in *Anopheles hyrcanus* var. *sinensis*, Wied., and summarises the chief points of a paper on this subject by Baisas and Hu [cf. R.A.E., B **26** 200]. Since Roubaud has stated that the morphology of the eggs is not a sufficient criterion for the distinction of biological races [cf. **21** 151], rearing experiments, which are described, were carried out with larvae from a locality near Hanoi, Tonkin, using the technique employed for rearing A. vagus, Dön. [cf. **26** 53], to obtain biological data. The duration of development varied greatly, so that the generations overlapped. Although the race reared was stenogamic, the failure of attempts to rear examples from other localities indicates that there may also be eurygamic races. From an examination of the eggs, which are here described, it was concluded that they belonged to the typical form.

Toumanoff (C.). Observations sur le comportement biologique de A. vagus dans les élévages.—Bull. Soc. Path. exot. 31 no. 5 pp. 407-410, 4 refs. Paris, 1938.

The author describes the results of continued rearing of *Anopheles vagus*, Dön., from September 1937 to February 1938, the cold dry season in Indo-China when this species is rare in nature, and compares them with those obtained from June to September [cf. R.A.E., B **26** 53], when conditions are particularly favourable for its reproduction. Five generations had been reared in the laboratory by January. During the winter season, the length of the life-cycle was greater

and the number of eggs laid was fewer than during the warm wet season; at both seasons several blood meals were necessary for the maturation of eggs, and the females usually died after laying a single batch of eggs. All females that paired in the laboratory laid fertile eggs.

Gill (C. A.). The Seasonal Periodicity of Malaria and the Mechanism of the Epidemic Wave.—Demy 8vo, xi+136 pp., 17 figs., 1 map, 4 pp. refs. London, J. & A. Churchill, Ltd, 1938. Price 10s. 6d.

This volume contains an account of a study of the seasonal periodicity of malaria in all parts of the world. In the introduction, the author points out that the relationship between the prevalence of Anophelines and the incidence of malaria is usually so close that it has come to be regarded as established that the seasonal periodicity of the disease is due to seasonal variations in the prevalence of the vector, and that the influence of climate and season is due to the creation of conditions favourable to the multiplication and longevity of the vector and to its power to transmit infection. This view does not, however, appear to be compatible with a number of facts, including the observation that the spring wave of malaria in many places occurs at a time when, either owing to the absence of Anophelines or to unfavourable meteorological conditions, or to both, the transmission of infection can never take place.

In the first part, four distinctive climatic zones of malaria are distinguished and their global distribution is determined. In the second, the epidemiological type of malaria characteristic of each zone is studied from data obtained in Holland, south Italy, the Punjab and Ceylon, and the seasonal wave is submitted to a detailed analysis. In the third, the general properties of the seasonal wave are discussed,

together with the factors concerned in its production.

It is concluded that benign tertian malaria (Plasmodium vivax) is everywhere characterised by two seasonal waves, one in spring and the other in autumn, whilst malignant tertian malaria (P. falciparum) is associated with a single seasonal wave in autumn. Every seasonal wave of both types of malaria is initiated by relapses (seasonal relapses) and when conditions are favourable for transmission, the relapse wave is followed by new infections [cf. R.A.E., B 24 116, 117; 25 46]. The spring and autumn periodicity of the seasonal wave varies systematically with latitude, occurring earlier in the year at medium than at either low or high latitudes. All seasonal waves due to relapses alone can invariably be represented by a symmetrical curve, the ascending and descending limbs of which are approximately equal; they reach their acme about the 6th week and last about 12 weeks. All seasonal waves occasioned by relapses followed by new infections can invariably be represented by an asymmetrical curve, the descending limb of which is longer than the ascending one; they reach their acme about the 6th week and last about 18 The epidemic wave is an exaggerated form of the normal autumnal wave [24 116]. The first type of curve is envisaged as the expression of a qualitative change of the malaria parasite, which is restricted to a period of about 12 weeks, and the second to the supplementary result of multiplication of the parasite in mosquito and man, varying with the availability of a non-immune population. The objective phenomena associated with both types of epidemic curves are essentially of a quantitative nature, but since the change of infection quantum is essentially attributable to an antecedent qualitative change of the malaria parasite, the latter must be regarded as the source of all seasonal and epidemic waves of malaria, and the main factor determining their magnitude and duration. From the clinical and epidemiological standpoint, however, the factors determining transmission are of paramount importance, since, in the absence of transmission, the wave will consist of relapses alone and the grave forms of malaria associated with new infection cannot occur. Moreover, in the permanent absence of transmission, no reservoir of infection can be maintained, so that the occurrence of seasonal relapse is ultimately dependent on the antecedent occurrence of transmission.

Huff (C. G.). The Significance of different Strains of Malaria and Mosquitoes in the Epidemiology of the Disease.—Amer. J. med. Tech. 4 no. 2 repr. 6 pp., 10 refs. Sine loco, March 1938.

After briefly reviewing the errors that have arisen in the explanation of the epidemiology of malaria through generalisations based on insufficient data, the author discusses some further possibilities relating to the significance of subspecific differences in the parasites and their vectors. If it be assumed that the species of Plasmodium are governed by the same laws of genetics as are other bisexual organisms, then each individual malaria parasite, mosquito and human being is different genetically from its parents, and genetic change will be influenced by isolation, selection, etc., factors that are known to bring about changes in other organisms. In this connection, the differences in ability to transmit malaria of the races of Anopheles maculipennis, Mg., are cited. These races, in so far as they have been tested, appear to be about equally susceptible to malaria parasites, and to differ in their ability to transmit the disease by virtue of differences in their biting habits and microclimatic requirements. far, there appears to be no record of two varieties of the same species differing in their susceptibilities to malaria, although there seems to be no good reason why such may not be the case, particularly since it has been shown in the author's studies on avian malaria that susceptibility to the parasite is an inherent characteristic of the individual mosquito, and that it is hereditarily transmitted as a simple recessive Mendelian character [cf. R.A.E., B 19 249, etc.]. Moreover, indirect evidence indicates that the degree of susceptibility of the individual mosquito may also be a function of heredity [cf. 22 48]. If these findings can be applied to Anophelines and human malaria, it would be possible for a mosquito population to change in its degree of susceptibility. Such a change would not be expected in countries where mosquitos breed in large numbers throughout the year, for in such cases the number of genes governing a characteristic tends to remain in the same proportion. However, such changes could occur in temperate regions where only a few individuals survive the winter. Droughts might bring about the same effect, as also might the segregation of certain characteristics by transport of a single mosquito or a few mosquitos from one faunal region to another by means of aeroplanes or other rapid conveyance. In the same way, malaria parasites similar morphologically may differ in physiological characters, and such differences may be genetic in character, in which case they would be expected to undergo changes during sexual reproduction.

Monier (H. M.). Caractères de l'anophélisme sur les plateaux de l'Emyrne.—55 pp., 20 photos. Tananarive, Gouvt gén. Madagascar, 1937. (Abstr. in *Bull. Inst. Pasteur* **36** no. 12 p. 651. Paris, 30th June 1938.)

This paper gives the results of two years' surveys in Imerina, Madagascar. The species of Anopheles in the order of abundance were A. funestus, Giles (with var. imerinensis, Monier & Treillard), A. gambiae, Giles, A. coustani, Lav. (mauritianus, Grp.), A. squamosus, Theo., and lastly, A. pharoensis, Theo., and A. maculi-palpis, Giles. The epidemiology of the disease and the results of dissection show that A. funestus and A. gambiae are the only vectors. The latter is most prevalent from the end of December to March and the former from then until July. The most important breeding places are cultivated rice-fields (A. gambiae and A. squamosus), small pools (A. gambiae) and particularly uncultivated or fallow rice-fields (A. funestus). The adults shelter most frequently in inhabited houses, cattle enclosures, vegetation around dwellings and piggeries. The results of a certain number of experiments on the nutrition of larvae are also given.

PAPADARIS (A. M.). The geographical Distribution and Prevalence of the Malaria-carrying Anopheline Species throughout Greece; Five Years Observations and Conclusions. [In Greek.]—Iatr. Athen. [Med. Athens] no. 119 repr. 8 pp., 29 refs. Athens, 1937.

As a result of five years' study (from 1931 to 1936) in different localities and in different seasons, the author gives an account of the geographical distribution and prevalence in Greece of the malaria vectors, Anopheles superpictus, Grassi, and A. maculipennis, Mg. (races sacharovi, Favr, messeae, Flni., and maculipennis). A list of 447 localities on the mainland and in the islands shows the distribution and prevalence of these Anophelines by means of letters and numbers. It would appear that few places are free from Anophelines and malaria. Race sacharovi is more prevalent in the northern part of the country, and A. superpictus in the southern part (the Peloponnesus, Crete and the small islands), although in areas where one predominates there are places where the other is also present. The other races of maculipennis are evenly distributed throughout the country. Race sacharovi is the most important vector of malaria and A. superpictus is next in importance.

Bana (F. D.). Control of Stegomyia fasciata (Aëdes aegypti) Mosquitoes in Indian Country Craft by a Mosquito-proof Metal Cap (Bennet Pattern) for Drinking Water Receptacles.—Indian med. Gaz. 73 no. 6 pp. 344-346, 5 figs., 1 ref. Calcutta, June 1938.

As a preliminary survey showed that Aëdes aegypti, L., was breeding in the water barrels or boxes of 51 per cent. of the country boats in Bombay harbour [cf. R.A.E., B 24 115], as many as possible were examined regularly and infested water was emptied out and replaced by a free supply. Although such action could not be enforced by legal powers until December 1936, the percentages of boats on which breeding was found were reduced to 28·7 in 1935–36 and 19·3 in 1936–37. A description is given of a perforated metal cap or filter that can be fitted to the opening of the ordinary water barrel or box to prevent the access of mosquitos.

PAPERS NOTICED BY TITLE ONLY.

- MÖNNIG (H. O.). Veterinary Helminthology and Entomology. The Diseases of domesticated Animals caused by Helminth and Arthropod Parasites. 2nd (revd) edn. Med. 8vo, xviii+409 pp., 12 pls., 264 figs. London, Baillière, Tindall & Cox, 1938. Price £1 10s. [Cf. R.A.E., B 22 183.]
- HALLER (H. L.) & SULLIVAN (W. N.). Toxicity of Hydrogenated Pyrethrins I and II to the Housefly [Musca domestica, L.]—
 J. econ. Ent. 31 no. 2 pp. 276–277, 7 refs. Menasha, Wis., April 1938. [See R.A.E., A 26 567.]
- HURLBUT (H. S.). Copepod [Cyclops varicans] observed preying on first instar Larva of Anopheles quadrimaculatus, Say [in a laboratory in Alabama.]—J. Parasit. 24 no. 3 p. 281. Lancaster, Pa, June 1938.
- Parker (R. R.). Rocky Mountain Spotted Fever [summary of present knowledge].—J. Amer. med. Ass. 110 pp. 1185–1188, 1273–1278. Chicago, April 1938.
- Thompson (G. B.). A Census of the Ectoparasites [sucking-lice, fleas, mites and ticks] of some Ceylon Rats.—J. Anim. Ecol. 7 no. 1 pp. 71–73, 5 refs. Cambridge, May 1938.
- [VLASOV (Ya. P.) & IOFF (I. G.).] Bracob (A. II.) n Noop (N. I.). Fleas from the Burrows [of rodents and hedgehogs] around Ashkhabad. [In Russian.]—Trud. Sov. Izuch. proizvod. Sil, Ser. turkmensk. no. 9 pp. 277–282, 3 refs. Leningrad, 1937. (With a Summary in English.)
- [ARGIROPULO (A. I.) & YAVRUMOV (V. A.).] Аргиропуло (А. И.) и Яврумов (В. А.). Zur Kenntnis der Aphaniptera-Fauna des Kaukasus. II. Die Flöhe der westlichen Mil-Steppe. [On the Siphonaptera of the Caucasus. II. Fleas occurring in the western Part of the Mil Steppe.] [In Russian.]—Trud. Azerbaij. Filiala Akad. Nauk SSSR. 20 (Zool. Ser.) pp. 79–86, 4 refs. Baku, 1937. (With a Summary in German.) [Argiropulo (A. I.)] Аргиропуло (А. И.). III. Aphaniptera-Sammlungen aus den Distr. Kachi u. Sakataly (Aserbaidshan). [III. Collections of Siphonaptera from the Districts of Kakhi and Zakatalui in Azerbaijan (including one new species and two new subspecies.)] [In Russian.] —T.c. pp. 87–101, 7 figs., 3 refs. (With a Summary in German.)
- [Argiropulo (A. I.).] Apruponyno (A. M.). Ueber eine neue Ctenophthalmus -Art (Aphaniptera) aus Suwand. [Ctenophthalmus iranus, sp. n., on rodents in Zuvand (Transcaucasia).] [In Russian.]—Trud. Azerbaij. Filiala Akad. Nauk SSSR. 20 (Zool. Ser.) pp. 105-110, 2 figs. Baku, 1937. (With a Summary in German.)
- [IOFF (I. G.) & TIFLOV (V. E.).] Иофф (И.Г.) и Тифпов (В.Е.). Manual for the Identification of Fleas (Aphaniptera) of the South-East of the European Part of the USSR. [In Russian.]—Demy 8vo, 116 pp., 171 figs, 61 refs. Saratov, Inst. Mikrob. Épidem. Yugo-Vost. SSSR, 1938. Price 3 rub.
- ZUMPT (F.). Eine neue Stechfliege aus Nigerien. [A new biting Fly (Stomoxys wigglesworthi, sp. n.) from Nigeria.]—Arch. Schiffs- u. Tropenhyg. 42 pt. 6 pp. 263-265, 2 figs. Leipzig, 1938.

CLARK (H. C.) & KOMP (W. H. W.). A seventh Year's Observations on Malaria in Panama.—Amer. J. trop. Med. 18 no. 3 pp. 271-288, 3 figs., 8 refs. Baltimore, Md, May 1938.

In the course of work described in this progress report for 1936–37 on experiments carried out in Panama on the control of malaria by means of various drugs, 355 females of Anopheles albimanus, Wied., caught in houses in a village in which combined atebrin-plasmochin treatment was being given were dissected and stomach infections were found in 4 (1·1 per cent.). In 1931-32, dissections had been made of 832 females of this mosquito caught in houses in towns in which plasmochin simplex was being administered; and the infection rate was 0.48 per cent. The general parasite rate in man for 1931-32 was 16.8 per cent. and for 1936-37 was 7.4. Thus, a relatively high mosquito infection rate can apparently exist even in the presence of a low malaria rate. However, too many variable factors are concerned in the determination of the mosquito infection rate to permit any very definite conclusions from such a small number of dissections. In spite of the difference in crude parasite rates, 13.2 per cent. crescent carriers were found in 821 cases of infection with Plasmodium falciparum in 1931-32, and 39·1 per cent. among 387 cases in 1936-37.

ROZEBOOM (L. E.). The Rôle of some common Anopheline Mosquitoes of Panama in the Transmission of Malaria.—Amer. J. trop. Med. 18 no. 3 pp. 289–302, 1 map, 21 refs. Baltimore, Md, May 1938.

Among the 17 species of Anopheles occurring in Panama, A. albimanus, Wied., has been considered the chief vector of malaria. The more recently discovered ones that belong to the subgenus Nyssorhynchus and might be dangerous as vectors are A. albitarsis, Arrib., A. bachmanni, Petrocchi, A. strodei, Root, and A. oswaldoi, Peryassú. A. oswaldoi breeds in fresh water in the depths of the jungle; it is abundant only in unpopulated districts and under existing conditions is of no importance as a vector. A. strodei breeds in fairly large numbers in restricted areas during the early part of the dry season, but does not seem to be prevalent enough, even during its short breeding season, to be of much importance; it does not apparently feed readily on man. An account is given of laboratory experiments on the infection of A. albitarsis and of observations on the habits of the adults of A. albimanus, A. bachmanni and A. punctimacula, D. & K., in the neighbourhood of two villages on the Chagres River several miles above the town of Gamboa.

The following is substantially the author's summary and conclusions: In seven experiments, totals of 100 females of A. albitarsis and 113 of A. albimanus were fed on carriers of gametocytes of Plasmodium falciparum; 4, or 4.0 per cent., of albitarsis became lightly infected, while 37, or 32.7 per cent., of albimanus controls became infected, many of them heavily, indicating that A. albitarsis in Panama is refractory to infection with P. falciparum, as compared with A. albimanus. A. bachmanni can be infected with human malaria parasites [cf. R.A.E., B 24 54], but its preference for animal blood renders it harmless so far as malaria transmission in Panama is concerned. A. punctimacula [cf. 24 145] frequently seeks blood in dwellings but it also feeds on animals. It is too scarce to be of importance in malaria transmission in the villages on the Chagres River.

The list of Anophelines known to be present in Panama is long, but as most of the species are rare, limited in their distribution, seasonal in their breeding habits, or feed on animals, malaria control is still dependent upon the control of *Anopheles albimanus*.

YEN (Chia-hsien). Studies on Dirofilaria immitis Leidy, with special Reference to the Susceptibility of some Minnesota Species of Mosquitoes to the Infection.—J. Parasit. 24 no. 3 pp. 189–205, 13 refs. Lancaster, Pa, June 1938.

An account is given of experiments undertaken to test the susceptibility of a number of species of mosquitos occurring in Minnesota to infection with Filaria (Dirofilaria) immitis, which has not been observed in this state. The mosquitos were dissected at intervals after feeding on an infected dog. Those that appeared to be entirely unsuitable as intermediate hosts were Aëdes trivittatus, Coq., in which the filarial larvae were unable to migrate into the malpighian tubes and either died after a short time in the gut or were eliminated through the anus, and Theobaldia inornata, Will., and Mansonia (Taeniorhynchus) perturbans, Wlk., in which the larvae were able to migrate to the malpighian tubes but soon died there. The species in which some of the filarial larvae completed their development but some became encapsulated and died were Aëdes canadensis, Theo. (encapsulation in microfilarial (early embryonic) stage), A. stimulans, Wlk., and A. cinereus, Mg. (encapsulation also in sausage (first larval) stage), and A. vexans, Mg. (encapsulation in microfilarial, sausage and pre-infective (second larval) stages). The species in which no encapsulation was noted were Culex territans, Wlk., C. tarsalis, Coq., and C. pipiens, L., in which the number of larvae that completed their development normally was small (low intensity of infection), and Anopheles maculipennis, Mg., and A. punctipennis, Say, in which the number of larvae completing their development was large (high intensity of infection).

Aëdes vexans, Anopheles maculipennis and A. punctipennis were the most susceptible species, because not only did all the examples fed become infected but the average numbers of larvae that became established in each mosquito were 40, 20 and 20, respectively. The other species of Aëdes were less susceptible, for although the average percentage that became infected was high, the average intensity of infection was only 10. The species of Culex were least susceptible, the average percentage and intensity of infection being 21 and 5 for C. territans, 34 and 3 for C. tarsalis, and 14 and 3 for C. pipiens. Because of the small numbers available, filarial larvae were not traced to their final stage of development in Aëdes spenceri, Theo., A. excrucians, Wlk., A. fitchi, Felt & Young, A. flavescens, Müller, and A. triseriatus, Say; the evidence indicates that they are susceptible but that the intensity of infection is comparatively low. The point of escape of the parasite from the labium of the mosquito, the tissue changes in infected mosquitos and the nature of the pigmented capsules are discussed. "Dutton's membrane" would appear to be a better point of exit during feeding than the tip of the labellum, and filarial larvae were observed to escape from it more often than from the labellum when the mosquito was fed on a drop of water under a cover slip on a slide. From the damage observed in the tissues of the mosquito, it is concluded that the filarial larvae are injurious to them.

Lane (J.) & Ayrosa Galvão (A.). Sobre a posição systematica de Anopheles gilesi Neiva, 1908.—Rev. Mus. paulist. 23 pp. 29-34, 1 pl., 14 refs. S. Paulo, 1938. (With a Summary in English.)

A re-description is given of the male terminalia of Anopheles gilesi, Neiva, which had not been mounted properly when the senior author described them previously [R.A.E.], B **24** 111]. The original description of the female is reproduced with a few corrections. The male terminalia, male palpus and wing are figured, and the species is referred to the Myzorhynchella group of the subgenus Nyssorhynchus.

Brett (G. A.). On the Relative Attractiveness to Aëdes aegypti of certain coloured Cloths.—Trans. R. Soc. trop. Med. Hyg. 32 no. 1 pp. 113-124, 1 fig., 12 refs. London, 25th June 1938.

The following is the author's summary: A method is described of comparing the attractiveness of different coloured cloths as alighting surfaces for mosquitos when about to feed. The mosquito used was Aëdes aegypti, L. It showed a preference for surfaces with a low reflection factor, especially black. Red was more attractive than several colours with a lower reflection factor. Blue was more repellent than several colours with a higher reflection factor. Light yellowish khaki was the most repellent colour. Yellow was also strongly repellent. The mosquitos were not prevented from alighting by a repellent colour, but the number doing so was reduced. When no attractive colour was present the reduction was small.

Statistical analyses of the results showed that most of the differences were significant, and demonstrated conclusively that this mosquito has colour vision and a colour preference as mentioned above. Further work is necessary before a detailed statement can be made about the

type of colour vision possessed by this insect.

CLASTRIER (J.). Observations sur les phlébotomes de la région de Privas (Ardèche).—Arch. Inst. Pasteur Algérie 16 no. 1 pp. 31-35. 1 ref. Algiers, 1938.

Between 26th June and 18th July 1937, 179 examples of *Phlebotomus perniciosus*, Newst., and 192 of *P. ariasi*, Tonn., were collected on the outskirts of Privas, in the South of France, chiefly from shelters in a garden. None was observed after 25th August. Many of the females were engorged, particularly those from a shed sheltering pigeons, fowls and rabbits, on which they had presumably fed. Four females of *P. ariasi* and 1 female and 2 males of *P. perniciosus* were taken in a bedroom, so that it seems probable that these sandflies also attack man.

RISTORCELLI (A.). Observations sur les phlébotomes de la région de Kébili (Sud Tunisien).—Arch. Inst. Pasteur Algérie 16 no. 1 p. 36. Algiers, 1938.

During the last two years, *Phlebotomus papatasii*, Scop., *P. longicuspis*, Nitzu., *P. minutus*, Rond., and *P. parroti*, Adl. & Thdr., have been collected at Kébili, in southern Tunisia. They are present from April until the beginning of November, but are abundant only in the autumn. *P. papatasii* is the species most numerous in dwellings, particularly in September. *P. longicuspis*, of which only one female has been taken, has not previously been recorded from this region. The other (2243) [B]

two species do not appear to attack man. Dermal leishmaniasis is not common, in spite of the presence in autumn of large numbers of P. papatasii. No cases of visceral leishmaniasis have been seen; P. longicuspis is the only species in the locality that would be capable of transmitting it. In Tunisia, visceral leishmaniasis occurs almost exclusively in the north and dermal leishmaniasis in the south.

Foley (H.). Techniques de prélèvements de laboratoire et de récolte de matériaux de parasitologie et d'histoire naturelle.—Arch. Inst. Pasteur Algérie 16 no. 1 pp. 54-104, 3 pls., 18 figs., many refs. Algiers, 1938.

A section of this paper (pp. 87–100) deals with methods of preserving and packing specimens of Arthropods, particularly noxious Diptera, that are to be forwarded for identification, with notes in some cases on methods of collection and rearing.

MACCHIAVELLO V. (A.). La Loxosceles laeta, causa del aracnoidismo cutaneo o mancha gangrenosa de Chile. [L. laeta, the Cause of cutaneous Arachnidism or gangrenous Spot in Chile.]—Rev. chil. Hist. nat. 41 (1937) pp. 11–19, 13 refs. Santiago, 1938.

The author has found that cases of cutaneous gangrene that occur in Chile are caused by the bites of a spider, Loxosceles laeta, Nicolet, which lives in old buildings, cellars, etc., and is common in summer. A detailed account of the symptoms and course of the affection is given.

MAZZA (S.), BASSO (G.) & BASSO (R.). Indices comparados de infestación por S. cruzi de triatomideos de dormitorios y gallineros en las provincias La Rioja y Catamarca. Presencia de E. oswaldoi en gallineros de la primera. [Comparative Indices of Infection by Trypanosoma cruzi of Triatomids from Bedrooms and from Poultry Houses in the Provinces of La Rioja and Catamarca. The Presence of Eutriatoma oswaldoi in Poultry Houses in the former.]—Publ. Misión. Estud. Pat. reg. argent. Jujuy no. 37 pp. 34-41, 1 fig., 1 map. Buenos Aires, 1938.

Of examples of *Triatoma infestans*, Klug, in various stages of development collected in the province of La Rioja, Argentina, 576 of 1,722 from bedrooms, 23 of 179 from fowl and pigeon houses, 56 of 64 from enclosures for rabbits and both of 2 from a goat enclosure harboured *Trypanosoma* (*Schizotrypanum*) cruzi. Of those collected in the province of Catamarca, 53 of 187 from dwellings and none of 30 from poultry houses were infected. *Eutriatoma oswaldoi*, Neiva & Pinto, was also found in a poultry house in La Rioja.

ESKEY (C. R.). Flea Infestation of Domestic Rats in San Francisco, Calif.—Publ. Hlth Rep. 53 no. 23 pp. 948-951. Washington, D.C., 10th June 1938.

Details are given of a rat-flea survey carried out in San Francisco in 1936 and 1937. Nearly two-thirds of the 3,027 rats trapped were infested, a proportion higher than that reported for most communities. The most numerous species of fleas were *Xenopsylla cheopis*, Roths., *Ceratophyllus (Nosopsyllus) fasciatus*, Bosc, and *Leptopsylla (Ctenopsyllus) segnis*, Schönh; the *cheopis* index was 2.0 for *Mus (Rattus)*

rattus, 2.6 for M. (R.) norvegicus and 3.2 for rats trapped in buildings. Only 5 examples of Pulex irritans, L., were taken, whereas 30 years ago this species averaged nearly one per rat. The widespread dissemination of fleas may be accounted for by the fact that X. cheopis is particularly adapted to existence on rats having close contact with buildings, whereas C. fasciatus thrives on rats nesting outside them.

Kissileff (A.). The Dog Flea as a causative Agent in Summer Eczema.—J. Amer. vet. med. Ass. 93 (N.S. 46) no. 1 pp. 21-27, 9 refs. Chicago, Ill., July 1938.

Summer eczema or summer dermatitis in dogs is discussed, an account is given of experiments carried out with the dog flea, Ctenocephalides (Ctenocephalus) canis, Curtis, and two cases illustrating the method of control adopted are described. It is concluded that the disease occurs only in dogs that are sensitive to flea bites, so that they bite and scratch themselves in an attempt to relieve the irritation, and that its appearance is entirely due to the presence of fleas. The clinical picture is chiefly that of self-inflicted traumata in various stages of healing. The bite of C. canis is considered to be the primary cause of the disease, which disappears in cold weather when the fleas become less active. It is believed that the various lotions used in external treatment owe much of their efficacy to flea-repellent chemicals. In tests of six flea-powders containing derris, pyrethrum and sodium fluoride, the only one that gave satisfactory results consisted of 31.25 per cent. derris and 68:75 per cent. powdered talc. Pyrethrum stupefies fleas temporarily, whereas rotenone, the active principle of derris, kills those with which it comes into contact. A combination of the two is useless, because the pyrethrum causes the fleas to drop off the animal before the derris has time to act and the fleas revive and return to the dog after it has shaken off most of the powder.

HORSFALL (M. W.). Meal Beetles as intermediate Hosts of Poultry Tapeworms.—Poultry Sci. 17 no. 1 pp. 8-11, 2 refs. Menasha, Wis., January 1938.

An account is given of experiments undertaken to determine whether the meal beetles, Tribolium castaneum, Hbst., T. confusum, Duv., Palorus sp. and Litargus sp., can act as intermediate hosts of the poultry tapeworms, Hymenolepis carioca, Choanotaenia infundibulum and Raillietina cesticillus. The beetles used were collected in Maryland from the surface of sacks of feeding stuffs and from sweepings from a barn between October 1936 and February 1937, and in order to acclimatise them to laboratory conditions, they were kept for at least a month in battery jars with pieces of burlap and dry chicken mash composed mainly of cereal products. In the first experiment, the beetles were confined for 3-5 days with fresh cestode segments and then kept for 4-6 weeks with chicken mash before being examined under a dissecting microscope or given as food to fowls. Both species of Tribolium became infected with cysticercoids of all three species of tapeworms, the total percentages infected being 14 for Hymenolepis, 28 for Choanotaenia and 54 for Raillietina, but the few examples of the other two species were all negative, except for two of Palorus sp., which became infected with Raillietina. Of 3, 15 and 6 fowls fed on beetles infected with H. carioca, C. infundibulum and R. cesticillus, respectively, 3, 5 and 5 became infected.

The second experiment was designed to test the popular idea that T. castaneum and T. confusum prefer cereal products and feed on animal matter only when these are lacking. Gravid segments of all three species of tapeworms were introduced daily for 7 days into the battery jar containing burlap and chicken mash in which about 2,000 beetles were living, after which the jar was left undisturbed for about a month. Of 51 examples of T. castaneum and 45 of T. confusum dissected, 5 and 1, respectively, contained cysticercoids of R. cesticillus, but none was infected with either of the other species. The remaining beetles (1,760) were divided into equal groups and given as food to 4 fowls, all of which became infected with R. cesticillus only.

- ROBERTS (F. H. S.). Cattle Lice: their economic Importance in Queensland.—Aust. vet. J. 14 no. 2 pp. 55–58, 8 refs. Sydney, April 1938.
- ROBERTS (F. H. S.) & LEGG (J.). Nicotine Sulphate: its Use in the Treatment of Cattle Lice (Haematopinus eurysternus Nitzsch).—
 T.c. pp. 58-60.

In the first paper, the lice infesting cattle in Queensland and the conditions under which they become of economic importance are briefly discussed, and in the second, an account is given of the experiments from which it was concluded that satisfactory control of these lice can be obtained by spraying cattle twice with nicotine sulphate [cf. R.A.E., B 26 148–149].

SEN (S. K.). Insects in relation to Disease of domesticated Animals.— Agric. Live-Sth India 8 pt. 3 pp. 235-244, 2 pls., 21 refs. Delhi, May 1938.

This is a popular survey of the known or suspected relation of various insects to the transmission of some common diseases of domestic animals in India, together with a general outline of the types of life-history typical for such insects.

BARANOV (N.). **K poznavanju golubačke mušice VI.** (Studij golubačke mušice i njezinih sinbiocenonta). [Contribution to the Knowledge of the Golubatz Fly. VI. (Study of the Fly and its Synbiocoenonts.).]—Vet. Arhiv **8** no. 7 pp. 313–328, 2 refs. Zagreb, 1938. (With a Summary in German.)

In the course of observations on *Danubiosimulium* (Simulium) columbaczense, Schönb., in Jugoslavia in 1937 [cf. R.A.E., B **26** 33], the author found that larvae occurred on branches of submerged willows, together with larvae and pupae of another Simuliid. The latter, the adult of which is at present unknown, he describes as *Echinosimulium echinatum*, gen. et sp. n., and, on the basis of larval and pupal characters, he also accords generic status to *Danubiosimulium*, originally erected as a subgenus for S. columbaczense [**23** 276].

The author has observed that a number of different insects occur in the swarms of males of D. columbaczense that congregate in suitable spots above streams near the Danube, and gives brief notes on 8 species caught in May 1936. They included Chirosia crassiseta, Stein, which is known to prey on the adults of D. columbaczense [cf.

22 204].

HUNDERTMARK (A.). Ueber das Luftfeuchtigkeitsunterscheidungsvermögen und die Lebensdauer der 3 in Deutschland vorkommenden Rassen von Anopheles maculipennis (atroparvus, messeae, typicus) bei verschiedenen Luftfeuchtigkeitsgraden. [On the Capacity for differentiating Air Humidity and on the Longevity at various Humidities of the three Races (atroparvus, messeae, typicus) of A. maculipennis found in Germany.]—Z. angew. Ent. 25 pt. 1 pp. 125-141, 2 graphs, 38 refs. Berlin, May 1938.

The following is largely taken from the author's summary of investigations on the three races of Anopheles maculipennis, Mg., found in Germany: Experiments on the reaction to relative humidity [cf. R.A.E., B 26 166] of newly emerged unfed females were made in August 1937 in a dark room at 20°C. [68°F.]. A flight chamber with two divisions was used, and on each occasion two different humidities were offered. The young mosquitos of all three races appeared to distinguish clearly differences in humidity as small as 1 per cent. preferred humidity differed with the race; it was 100 per cent. for atroparvus, van Thiel, about 97 per cent. for messeae, Flni., and about 95 per cent. for maculipennis (typicus). Investigations in which young adults were kept at 19 and 30°C. [66·2 and 86°F.] showed that, on the whole, their longevity increased directly with relative humidity and inversely with temperature. At each degree of humidity, the females outlived the males. It appeared probable that the young adults reached their vital optimum at the particular relative humidity preferred by them. The most resistant race at 19°C. and 100 per cent. humidity was atroparvus, whereas in dry air (0 and 32 per cent. humidity) it was maculipennis: messeae had the shortest duration of life at all relative humidities. The relation between these results and the distribution of the three races is discussed. The author believes that investigations on the preferences of the races and on their resistance to their environment (biological valency) may give data applicable not only to their reactions to the microclimate of dwellings and animal quarters, but also to the factors concerned in their local and geographical distribution.

CORRADETTI (A.). Ricerche epidemiologiche sulla malaria nella regione Uollo-Jeggiu durante la stagione delle piogge. [Epidemiological Investigations on Malaria in the Uollo Jeggiu Region (in Abyssinia) during the Rainy Season.]—Riv. Malariol. 17 (1) fasc. 2 pp. 101-110, 1 map. Rome, 1938. (With a Summary in English.)

CORRADETTI (A.). Ricerche sulla biologia dell'Anopheles (Myzomyia) gambiae.—Riv. Parassit. 2 no. 2 pp. 143-150, 1 fig., 7 refs. Rome, May 1938. (With Summaries in French, English and German.)

The first paper contains an account of investigations on Anophelines and malaria near Dessie carried out from July to October 1937, a summary of which has already been noticed [R.A.E., B **26** 183]. In the second are recorded further investigations on Anopheles gambiae, Giles, during the same period and in the same locality. The minimum duration of the larval stage in August-September was 9 days. Of adults reared in the laboratory, 53 per cent. were females; 214 out of 218 females that had emerged in the previous 48 hours fed on man

within 10 minutes. Only 4 batches of viable eggs were obtained when 214 females and 400 males were kept in ordinary laboratory cages measuring $18\!\times\!14\!\times\!10$ inches.

KING (W. V.). On the Distribution of Anopheles albimanus and its Occurrence in the United States.—Sth. med. J. 30 no. 9 pp. 943–945, 16 refs. Birmingham, Ala., September 1937.

The northern limits of the natural range of Anopheles albimanus, Wied., lie near the southern boundary of the United States and it has been reported from several points in the extreme south of the country. It appears to be established in the area of Brownsville, Texas, and since it may become established elsewhere, the records of its present distribution are reviewed. The chief characteristics of the areas in which it occurs appear to be a warm damp climate and low altitudes. Throughout almost the whole of its range, it is usually the predominant Anopheline in the coastal areas and lowlands, but is replaced by other species in dry climates and at higher elevations. It is most prevalent from central Mexico to Panama and the northern coast of South America (from about 24 to 8°N. Lat.), but it has been found as far north as southern Texas (26°N. Lat.) and as far south as south-central Ecuador (about 3°S. Lat.). A comparison of the temperature and rainfall in places from which it has been recorded with those in other selected stations in the southern part of the United States indicates that conditions favourable for its existence also occur over a considerable area of Florida. The southern part of Florida is at present largely free from malaria, probably because the prevalent Anopheline, A. crucians, Wied., is of little importance as a vector. In view of the danger that A. albimanus might be introduced and become established, the author urges further study of the climatic and other factors affecting its distribution.

EARLE (W. C.). The Relation between Breeding Area, Anopheles albimanus Density, and Malaria in Salinas, Puerto Rico.—Sth. med. J. 30 no. 9 pp. 946-949, 2 charts. Birmingham, Ala., September 1937.

Observations of mosquito density and malaria prevalence have been carried out at Salinas, Porto Rico, since 1928, and control of Anopheline breeding places by drainage was begun in 1930. Tables are given showing the average numbers of Anopheles albimanus, Wied., caught per trap in the zone under control and the numbers of malaria cases there for each month of each year from 1928 to 1935. The average monthly catch was highest (22·14) in 1933 and lowest (1·2 and 0·82, respectively) in 1934 and 1935; the corresponding numbers of malaria cases per year were 730, 169 and 52. It appears that it was necessary to control practically all of the enormous breeding places before mosquito density was definitely reduced, and that mosquito density had to be maintained at an extremely low figure before the malaria prevalence was affected. Where control depends on engineering measures that require several years for their application, definite results cannot be expected until the last breeding area has been dealt with; in view of this fact, the order in which the breeding places are treated is probably of little importance.

ROZEBOOM (L. E.). On Anopheles albitarsis Lynch Arribalzaga in Panama.—Sth. med. J. 30 no. 9 pp. 950-951, 3 figs., 5 refs. Birmingham, Ala., September 1937.

The egg of Anopheles albitarsis, Arrib., from Panama is described; it is quite dissimilar from that of the same species from the coast of Brazil, as described in a paper already noticed [R.A.E.], B 14 198]. Since in Panama this species shows a marked indifference to human blood and in Brazil is considered a vector of malaria [cf. 14 198; 20 96], it is suggested that it consists of at least two races.

HILL (R. B.). The Length of Life of Anopheles maculipennis, var. atroparvus.—Sth. med. J. 30 no. 9 pp. 952-953, 7 refs. Birmingham, Ala., September 1937.

A brief account is given of experiments carried out in Spain under conditions as nearly natural as possible to determine the adult longevity of *Anopheles maculipennis* var. *atroparvus*, van Thiel. Overwintering females lived for at least 6 months, but females that emerged in early May or late June survived for a maximum of only 6 weeks.

HILL (R. B.). The Malaria Problem in Portugal.—Sth. med. J. 30 no. 9 pp. 953-956, 7 refs. Birmingham, Ala., September 1937.

A malaria survey of Portugal was carried out in 1933, and a malaria station was established in 1934 in the centre of the most malarious region. This report on malaria and its control is based chiefly on data obtained during the survey and subsequently at the station. disease is a serious problem in the valleys of three of the principal rivers and is also prevalent in the valleys of two others in smaller areas where the Anopheline density is high. Elsewhere it is of no great importance. The species of Anopheles found were A. claviger, Mg. (bifurcatus, auct.), which is rare and not concerned in transmission, and A. maculipennis, Mg. The latter is represented by race maculipennis (typicus), which occurs in relatively small numbers over a limited area in the northern and central parts of the country, feeds chiefly on cattle and is probably of no importance as a vector, and race atroparvus, van Thiel, which is present in all regions whether malarious or not. The latter race is the only vector of importance in Portugal and western Spain. It has no special preference for human blood and seems to be a vector only when its density is high. In spite of the fact that the most malarious regions are at or near tide water level, it breeds locally in fresh water. In rice-fields, where the most extensive breeding occurs, the total chloride content is usually less than 100 mg. per litre, in spite of the rapid evaporation and presumable concentration of solids. On a few occasions, larvae have been found in water with a content of 400 mg. and once with a content of 700 mg. Brackish water contains by definition more than 1,000 mg. per litre. Elsewhere in Europe, except in western Spain, race atroparvus breeds in brackish water, and except in Holland, where conditions of transmission are unusual, it is considered to be relatively harmless. There are, however, areas in Portugal where malaria is as intense as anywhere else in

Practically all the high malaria indices were found in towns and villages where rice is the principal crop, but a small amount of epidemic malaria occurs in the southern and eastern section of the country

where rice is not grown but where sluggish streams give rise to large numbers of race atroparvus. The only important malarious area where there is no rice is along the Douro River and its tributaries; here the streams dry up in summer and form large pools. In the delta of the Vouga River, about 30 miles north of a rice-growing region where malaria is prevalent, a considerable amount of rice is grown and swampy land and water are abundant, but malaria is practically absent. Race atroparvus is found there in large numbers in stables and other suitable shelters in association with race maculipennis.

The method of rice cultivation is described, and various possible methods that might be used for the control of malaria are discussed. It is concluded that the screening of barracks for itinerant labour [cf. 24 229] and improvements in agricultural methods are necessary, and that intermittent irrigation of rice-fields is the most promising method of controlling Anopheline larvae. This method has been tried experimentally on a fairly large scale over a period of two years and the results have been encouraging. After flooding for 10 days, the water was turned off for 4–8 days, while the fields drained and dried to the consistency of putty (an absolutely dry surface is not necessary to kill the larvae). Breeding was completely eliminated and the rice crop apparently benefited by the reduction in undesirable algae and weeds. The increase in yield was sufficiently great to arouse the interest of some of the more progressive growers and of the government agronomists.

Brown (A.), Griffitts (T. D. H.), Erwin (S.) & Dyrenforth (L. Y.). Arthus's Phenomenon from Mosquito Bites. Report of a Case with experimental Studies.—Sth. med. J. 31 no. 6 pp. 590-595, 2 figs., 14 refs. Birmingham, Ala., June 1938.

An account is given of a case in the south of the United States in which exceptionally severe reaction always followed the bites of mosquitos, particularly those of Aëdes aegypti, L. The reaction, in which the original weals were followed by the formation of blebs, with subsequent necrosis and scarring, is considered by the authors to be a local anaphylactic phenomenon. Attempts at desensitisation by injections of extracts made from whole mosquito bodies and from the salivary glands were unsuccessful. This case of skin necrosis in man resulting from mosquito bites is believed to be the first to be published.

[Enikolopov (S. K.) & Marchevskii (A. P.).] Ениколопов (С. К.) и Марчевский (А. П.). Les foyers du paludisme dans la partie montagneuse du Daghestan (Caucase). [In Russian.]—Med. Parasitol. 7 no. 1 pp. 44–54, 1 map, 6 refs. Moscow, 1938. (With a Summary in French.)

The Anophelines found during a survey in the mountainous part of Daghestan in 1935 were Anopheles maculipennis, Mg., A. superpictus, Grassi, A. hyrcanus, Pall., and A. claviger, Mg. (bifurcatus, auct.). A. maculipennis, which was found at altitudes of up to 6,900 ft., was the only species that was widely distributed. Its larvae were found in numbers in large shallow collections of water in river beds, well exposed to the sun and covered with aquatic vegetation, as well as in swamps and pools formed by numerous streams or by neglected

irrigation ditches and in old water reservoirs. The adults were equally abundant in animal quarters and inhabited huts. During the spring floods the rivers became free from Anopheline larvae, which were carried away by strong currents of water, except along the banks. The population of the districts in which most of the breeding places were found suffered severely from malaria, but its incidence was considerably reduced by treatment of infected persons and the destruction of a number of Anopheline breeding places in 1935 and 1936.

[Pokrovskii (S. N.) & Polikarpova (L. I.).] Покровский (С. Н.) и Поликарпова (Л. И.). Index oocystique des anophèles, importés à Stalingrad par les bateaux à vapeur locaux. [In Russian.]—
Med. Parasitol. 7 no. 1 pp. 55-60, 1 map. Moscow, 1938. (With a Summary in French.)

As it has been found that adults of *Anopheles maculipennis*, Mg., are carried on steamers to Stalingrad and Astrakhan from villages on the Volga [R.A.E., B **26** 46], investigations were made between 20th June and 9th September 1937 to determine to what extent they were infected with malaria. Of the examples of this mosquito caught on the boats, 97·5 per cent. were females; they were kept in muslin cages at 23–25°C. [73·4–77°F.] for 9–11 days before being dissected. Oöcysts were found in 13 out of 1,609 mosquitos, but no sporozoites were found in 514 of which the glands were examined. Most of the infected females were taken in August.

[Viktorov (S. V.).] Винторов (С. В.). A propos de la lutte contre les moustiques ailés. [In Russian.]—Med. Parasitol. 7 no. 1 pp. 61-68. Moscow, 1938. (With a Summary in French.)

An account is given of successful experiments carried out on a large scale in Tadzhikistan in 1936, in which mosquitos in houses and tents were destroyed by spraying with a water solution of soft natron soap with the addition of a small quantity of methylated spirit. In the houses, 6–7 sprayers were worked simultaneously, some of the jets being applied so as to drive the mosquitos out of their shelters, while others were directed against those that flew to windows or cracks in the walls. It is estimated that at least 90 per cent. of mosquitos were destroyed in this way; those that lived until the liquid on them dried were unable to fly, as their wings were glued by the soap film. Over 500 tents and houses were treated twice in 4 days and then remained free from mosquitos for about 20 days. Sandflies (*Phlebotomus*) were also killed by the spray, but Muscoid flies were not.

[Prendel' (A. R.).] Прендель (A. P.). The Distribution of Anopheles maculipennis Subspecies in the Odessa Region (South Ukraine). [In Russian.]—Med. Parasitol. 7 no. 1 pp. 69-76, 1 diagr., 2 figs., 18 refs. Moscow, 1938. (With a Summary in English.)

Of 575 batches of eggs deposited by females of Anopheles maculipennis, Mg., caught chiefly in animal quarters, in different parts of the Province of Odessa between January and October 1936, 74·2 per cent. belonged to race messeae, Flni., 15·4 per cent. to race atroparvus, van Thiel, and 10·4 per cent. to race maculipennis (typicus). Race messeae was predominant almost everywhere and was particularly so in the low-lying flooded areas of the rivers Dnieper and Dniester, where there is no brackish water. Race typicus was practically absent from the flooded areas, but became more abundant as the country became higher towards the north. On the other hand, atroparvus occurred more frequently towards the south as the salinity of the waters increased, and was the predominant race on the Black Sea coast. All three races occurred together in the area of mainly fresh waters in the steppe and forest-steppe zone and the differences in their relative abundance were less marked. Eleven batches of black eggs were also obtained, which from their characters and those of the larvae that hatched from them are considered to represent a melanic form of atroparvus.

[Tishchenko (O. D.).] Тищенко (O. Д.). A propos de la question des variétés de l'Anopheles maculipennis dans les endroits d'hibernation en Ukraine. [In Russian.]—Med. Parasitol. 7 no. 1 pp. 77-87. Moscow, 1938. (With a Summary in French.)

An account is given of observations carried out between 20th November 1935 and 27th March 1936 on the behaviour and physiology of females of Anopheles maculipennis, Mg., taken in typical hibernation quarters in stone cellars and animal quarters in two villages near Kharkov. The races that occurred in these localities in the summer were maculipennis (typicus) and messeae, Flni., of which the latter predominated [cf. R.A.E., B 25 145]. All the eggs (a total of 288 batches) that were obtained from the winter females belonged to race messeae, which indicates that the typical race probably hibernates chiefly out of doors. This view was supported by the fact that 3 batches of eggs of the typical form occurred among the 68 batches laid by females taken in April-May in cellars and animal quarters that had been completely freed from hibernating mosquitos by spraying or fumigation, but gradually became reinfested with individuals from the open. The percentage of mosquitos having a developed fat-body in autumn increased more rapidly in cellars than in animal quarters, and engorged individuals were not found in the former, whereas they occurred in the latter till the end of October and reappeared in March. Moreover, mosquitos without a fat-body occurred earlier in spring in animal sheds than in cellars, and the mass flight from the former took place in the first half of April and from the latter in the second half. Of the hibernating mosquitos given the opportunity of feeding on rabbits in the laboratory at 17-18°C. [62·6-64·4°F.], 39·2 per cent. fed. The percentage that did so was lowest in December and January, after which it steadily increased every month, irrespective of the temperature that prevailed in the hibernation quarters, which was lowest in February. Several of the mosquitos that sucked blood possessed a well developed fat-body, but on the whole the percentage that fed increased as the fat-body was reduced. The digestion of blood and the maturation of eggs progressed differently in the different individuals, though all were kept under identical conditions at 24°C. [75·2°F.] and 90 per cent. relative humidity. Most of the females oviposited after only one blood-meal and the percentage that did so steadily increased from November till March. In other individuals, the eggs did not mature even after a second feed. The period in which digestion was completed varied from 3 to 6 days.

[AVANESOV (G. A.).] ABAHECOB (F. A.). Cas de spirochétose transmis par des tiques en Afghanistan. [In Russian.]—Med. Parasitol. 7 no. 1 pp. 88–94, 1 graph, 2 figs. Moscow, 1938. (With a Summary in French.)

During investigations carried out in villages and towns in northern Afghanistan in 1934–37, ticks of the genus *Ornithodorus* were found in native dwellings of various kinds and in half ruined buildings. This accounts for cases of tick-borne relapsing fever, which frequently occur in the country, particularly in early summer and late autumn. An account is given of the clinical history of several cases observed by the author; all the patients had been bitten by *Ornithodorus* and spirochaetes were present in their blood.

[Khelevin (N. V.).] Хелевин (H. B.). Sur les lieux d'hibernation des anophèles dans la nature libre dans les conditions de la région d'Ivanovo. [In Russian.]—Med. Parasitol. 7 no. 1 pp. 144-145, 3 refs. Moscow, 1938. (With a Summary in French.)

In investigations carried out in the Province of Ivanovo (central Russia) in 1937 to determine whether Anopheles maculipennis, Mg., can hibernate outside buildings, small glass plates covered with a thin layer of a mixture of castor oil and colophony (1:2) were laid with the sticky surface down on the openings of different possible hibernation quarters to catch the mosquitos that emerged. It was found in this way that A. maculipennis hibernates in holes in trees and under the roots of stumps, but it was not caught emerging from the burrows of mice or moles, or from those of sand martins. The overwintered mosquitos emerged from the field hibernation quarters at the same time that they left dwellings and animal quarters.

[KHELEVIN (N. V.).] Хелевин (H. B.). The Occurrence of A. bifurcatus (L.) in the Province of Ivanovo. [In Russian.]—Med. Parasitol. 7 no. 1 p. 145. Moscow, 1938.

In October 1937, larvae of Anopheles claviger, Mg. (bifurcatus, auct.) were taken in two localities in the Province of Ivanovo (central Russia) where this species has not previously been recorded. The larvae were found in a stream from a spring and in pools in a stream bed; in both cases the water was shaded.

Ball (Bedia). Action des extraits de tabac sur les larves de moustiques.

—Riv. Malariol. 17 (1) fasc. pp. 122-125. Rome, 1938. (With a Summary in Italian.)

It is believed in Turkey that accidental collections of water in tobacco-growing districts are unfavourable to mosquito larvae, and that the tobacco waste that accumulates in the irrigation channels renders them unfit for breeding. In some malarial districts, especially at Brussa, Dr. Asim Sekip has obtained fair results by throwing tobacco waste into the breeding places.

In laboratory experiments, larvae of *Culex pipiens*, L., were placed in jars of water containing an alcoholic extract of tobacco at concentrations of from 0.02 to 2 per cent. At concentrations of 2 and 0.2 per cent. all larvae were killed in 3 and 16 hours, respectively; at weaker concentrations, about 20 per cent. were alive after 22 hours.

In further tests, an aqueous extract corresponding to 1 per cent. of tobacco, prepared with or without the addition of 25 per cent. lime to the tobacco, was used at the rate of 1 part to 200 parts water. The extract prepared without lime and lime alone at the same concentration were completely ineffective, but the extract prepared with lime killed all the larvae within 2 hours. When diluted with 300 parts or more of water, however, the 1 per cent. extract with lime was ineffective. It is concluded that tobacco is of no practical value against mosquito larvae.

Galliard (H.) & Dang-Van-Ngu. Variations saisonnières de l'évolution de Dirofilaria immitis chez Aëdes (Stegomyia) albopictus.—Ann. Parasit. hum. comp. 16 no. 3 pp. 210–214, 1 pl., 3 graphs, 4 refs. Paris, May 1938.

Experiments at Hanoi on the development of Filaria (Dirofilaria) immitis in Aëdes albopictus, Skuse [R.A.E., B 25 232] were continued from 29th April 1937 to 2nd January 1938 (that is, from the beginning of the hot season to the middle of the cold season) to determine, under conditions as natural as possible, the influence of temperature. The same dog was used as the source of infection throughout this period. The following is taken from the authors' summary: Development, which took place readily in 80–100 per cent. of the mosquitos throughout the hot season, was completed in 8–9 days from May to September when the temperature ranged from 24 to 37°C. [75·2–98·6°F.]. In winter when the temperature ranged from 12 to 18°C. [53·6–64·4°F.] only a small number of females became infected and development took more than a month.

Brumpt (E.). Fréquence et origine des "Black Spores" de Ross au cours de l'infection des stégomyies par le Plasmodium gallinaceum.

—Ann. Parasit. hum. comp. 16 no. 3 pp. 220-241, 4 pls., 2 figs., 34 refs. Paris, May 1938.

The author gives an account of observations on "black spores" made in the course of his experiments on the transmission of Plasmodium gallinaceum by Aëdes aegypti, L. (Stegomyia fasciata, F.) and A. (S.) albopictus, Skuse [R.A.E., B 25 121], summarises the various hypotheses that have been formulated concerning them [cf. 24 286, etc.], reviews the experiments in the literature in which they are discussed, and, finally, gives his own views on their origin. He considers that the occysts of human or avian plasmodia may undergo chitinous degeneration, giving rise either to spherical or flattened bodies that are more or less dark, or to true banana-shaped black spores, which are formed around groups of sporozoites or independently of them. The black spores, single or in groups, observed in various parts of the body of the mosquito (muscles, salivary glands) are probably produced round dead sporozoites, chitinised on the spot, that become foci for the deposition of successive layers of chitin, regular or irregular, that constitute the black spores. The circular masses formed by 20-100 black spores, situated on the external wall of the stomach, may be formed by the rupture of an oöcyst. Oöcysts may undergo chitinous degeneration even before sporozoites are formed. The irregular and amorphous masses of chitin, often very large, that are sometimes observed are probably not related to oöcysts, for they may appear in uninfected mosquitos. The conditions that determine the formation of black spores are difficult to discover. Under identical conditions of temperature, humidity and lighting, the percentages of mosquitos in which they were found were often very different.

Feng (Lan-chou). A critical Review of the Literature regarding the Records of Mosquitoes in China. Part I. Subfamily Culicinae, Tribe Anophelini.—Peking nat. Hist. Bull. 12 pt. 3 pp. 169–181. Peiping, 1938. Part II. Subfamily Culicinae, Tribes Megarhinini and Culicini.—T.c. pt. 4 pp. 285–318, 7 pp. refs.

Examination of the literature showed that 98 valid species and varieties of mosquitos have been reported from 21 provinces in China. Lists of these are given showing the synonymy, the records, the breeding places of the larvae, the habits of the adults and their relation to disease. Lists are also given of the species that have been doubtfully or erroneously recorded from China. An index to the species mentioned in both parts is given in the second.

Lamborn (W. A.). Annual Report of the Medical Entomologist for 1937.—Annu. med. sanit. Rep. Nyasaland 1937 pp. 59-61. Zomba, 1938.

Surveys carried out in November in the Lilongwe, Dowa and Fort Manning Districts of Nyasaland showed that the retreat of Glossina [morsitans, Westw.] in a northerly direction is continuing [cf. R.A.E., B 26 33] and it is estimated that about 150 square miles have been vacated since 1936. Although clearing and settlement appear to have been responsible for bringing to an end the advance of the fly that had gone on for many years prior to 1926, they are not believed to be concerned in the continued diminution in its numbers. This appears to be due to the scarcity of game, which has either been shot or has withdrawn to the reserve in the north. A parasite survey has been initiated, but the results obtained during the last three months of 1937 in one area do not indicate that parasitism is playing an important part in the reduction of the fly. Most of the fleas obtained from rodents belonged to the genus Xenopsylla; they included X. brasiliensis, Baker, and X. piriei, Ingram, which were the most common, and a new species [X. syngenis, Jord. (25 256)].

[Hargreaves (H.).] Report of the Entomologist.—Rep. med. Dep. Uganda 1937 pp. 59-60. Entebbe, 1938.

A rat and flea survey of the plague-free part of the Mubende district of Uganda indicated that Mus (Rattus) rattus was absent. M[astomys] coucha and A[rvicanthis] abyssinicus occurred more frequently in native dwellings in this district than in the neighbourhood of Kampala and harboured a greater number of fleas of the genus Xenopsylla than usual, although X. cheopis, Roths., was not found. Investigations in other plague-free areas indicated that M. rattus was absent, except in Paranga county; X. cheopis was found on rodents in the West Nile and Gulu districts. Investigations were made on the incidence

of Aëdes aegypti, L., in rural areas in the West Nile district; it was found in areas up to 20 miles from non-African habitations. Since it has been suggested that in the Northern Province Glossina palpalis, R.-D., occurs only in the very narrow strip of bush or forest adjoining streams, experimental clearings have been made that are very long but extend only 10 yards from the banks of the stream (rod-clearings). Up to the present, experience suggests that fly still remains in them, but may be reduced in density. In the course of a study of the breeding places of flies that frequent dwellings, it was found that a species of Musca sometimes breeds in very large numbers in coffee pulp used as manure. Two cases of myiasis in man were due to Lucilia cuprina, Wied., and Chrysomyia bezziana, Villen., respectively, and three others to unidentified species of Lucilia. C. bezziana has not previously been recorded as occurring in Uganda or as causing human myiasis in Africa.

GOIDANICH (A.). Esperimenti di lotta contro le larve della mosca domestica con l'impiego di calciocianamide sul letame. [Experiments in combating the Larvae of the House-fly by using Calcium Cyanamide on Stable Manure.]—Rass. faun. 5 pt. 1 repr. 33 pp., 14 figs., 18 graphs. Rome, 1938.

A detailed account is given of 68 experiments with about $4\frac{1}{2}$ tons of stable manure to test the insecticidal action of calcium cyanamide on larvae of Musca domestica, L. The calcium cyanamide was either sprayed or dusted on the heaps or thoroughly mixed with the manure. It proved quite ineffective, even in quantities amounting to 2 per cent. of the weight of the manure, which is over three times the rate at which it is mixed with manure for use in agriculture.

PAPERS NOTICED BY TITLE ONLY.

- PARROT (L.). Phlébotomes du Congo belge. VII. Phlebotomus wansoni n. sp.—Rev. Zool. Bot. afr. 30 fasc. 3 pp. 361–363, 2 figs., 5 refs. Brussels, 21st May 1938.
- MATHIS (M.). Élevage en série (cinq générations) d'un Stegomyia de Java; Aëdes annandalei Theobald.—Bull. Soc. Path. exot. 31 no. 6 pp. 493–497, 7 refs. Paris, 1938.
- BARANOV (N.). Die Kolumbatscher Mücke (Danubiosimulium columbaczense Schönb.). [A Survey of data on Danubiosimulium columbaczense, Schönb., in Jugoslavia.]—Z. hyg. Zool. Schädl-Bekämpf. 30 pt. 6 pp. 161–178, 1 map. Berlin, June 1938. [Cf. R.A.E., B 26 33, etc.]
- Peters (G.). Begasungsanlagen. Von der Gaskiste zur Kreislauf-Kammer. [A review of fumigation equipment: from the gas box to the chamber through which a mixture of air and gas is circulated from outside.]—Z. hyg. Zool. SchädlBekämpf. 30 pt. 6 pp. 178–187, 9 figs. Berlin, June 1938.
- IMPERIAL INSTITUTE. Quarterly Bibliographies on Insecticide Materials of Vegetable Origin, Nos. 1-3 (October 1937 to June 1938).—Bull. imp. Inst. 36 nos. 1-3 pp. 123-127, 284-289, 438-444. London, 1938.

Hobson (R. P.). Sheep Blow-fly Investigations. VI. Toxicity of Stomach Poisons to Sheep Maggots.—Ann. appl. Biol. 24 no. 4 pp. 808-814, 3 refs. London, November 1937. VII. Observations on the Development of Eggs and Oviposition in the Sheep Blow-fly, Lucilia sericata Mg.—Op. cit. 25 no. 3 pp. 573-582, 11 refs. August 1938.

In the second part of the first paper, an account is given of experiments carried out in Wales (a summary of which has already been noticed [R.A.E., B 25 218]) to test the effect on infestation of sheep by blowflies of dips containing arsenic, carbolic acid, sulphur, nicotine, pyrethrum powder or derris powder. The repellent effect of these substances was tested by treating sheep, at various intervals after dipping, with an attractant (a solution of ammonium carbonate and indole) and thus determining when the repellent effect had worn off. Parallel tests were made with undipped sheep. of the materials rendered the sheep repellent for more than 10 days. The toxic effect was measured by feeding larvae of the sheep blowfly [Lucilia sericata, Mg.] on blood serum mixed with samples of wool taken from the base of the fleece at intervals after dipping. With the exception of those containing arsenic, none of the dips rendered the fleece toxic for more than a few days, and with the arsenic dips there was a certain amount of injury to the skin.

For this reason, a search is being made for a substitute for arsenic, and an account is given in the first part of this paper of experiments to test the toxicity of certain stomach poisons. Larvae, chiefly those of the second instar, were allowed to feed for 16 hours (and in a few cases for 4 hours) on a solution of dried serum and marmite in which different concentrations of the poisons were dissolved or suspended; the numbers dead at the end of the period were counted and the concentration of poison necessary to kill 50 per cent. was calculated. The arsenites were considerably more toxic than the corresponding arsenates, but this superiority was not so marked when the lead salts were tested over the shorter period. Of the fluorine compounds, sodium fluosilicate was highly toxic, but artificial cryolite was not. Barium fluosilicate seems to be a possible substitute, since it combines a fair degree of toxicity with a low solubility; it was, however, slow in action, since a much higher concentration was necessary in the shorter test. The organic poisons tested gave promising results. Lauryl thiocyanate was toxic at very low concentrations even in the shorter test; thiodiphenylamine and Lethane 384 (a proprietary insecticide in which the active principle is an alkyl thiocyanate) were also poisonous at low concentrations.

In the second paper an account is given of investigations on the adults of L. sericula with reference to the development of eggs and to oviposition. At different temperatures ranging from 37 to $15-16^{\circ}\text{C}$. [98.6 to 59–60.8°F.], the number of days required for the development of mature eggs in recently emerged females ranged from 2 to 13, and the average interval in days between the first and subsequent ovipositions in fertilised females from 1.2 to 5.5. Mortality was high at the highest temperature and oviposition was irregular at the lowest. The figures represent minimum values, since the flies were kept under optimum conditions of nutrition. Experiments to determine the number of meat meals necessary for the development of eggs in the ovaries showed that at least two were necessary, both in recently

emerged flies and in fertilised females that had already oviposited once. The process of egg development appears to occur in two stages; in flies that had received only one meat meal the eggs were always found in the form of small spheres, and not until a second meal had been taken did they elongate and become opaque. Females fed on liver may consume as much as 15 mg, juice, so that not more than 30 mg. liver juice is necessary in addition to carbohydrate for the development of a batch of eggs. Development of eggs occurred when flies were fed on meat or on blood serum mixed with marmite, but not when they were fed on milk, sheep dung, dog dung, various plant materials or blood serum alone. The oviposition response of the gravid female consists of two phases, attraction from a distance and stimulation to oviposit. In the case of sheep, the first phase depends on two factors, one supplied by the live animal, the other by products of protein decomposition [cf. 25 52]. Similarly, the attraction of carrion may be produced by putrefactive products combined with other odoriferous substances present in carrion. The second phase depends on several factors; it was produced by certain chemicals, namely, indole, skatole, ammonium hydroxide, trimethylamine, ammonium carbonate, ethyl alcohol and suint (the sample used was a water extract of wool, which had stood for several months in the laboratory and had decomposed), but is also a tactile response. A meal often seems to stimulate oviposition, probably because it distends the abdomen so that the ovipositor is more liable to touch the object. For this reason, it is usually easier to induce oviposition on meat than on materials that do not supply food. Differences in nutrition were probably the cause of variation in oviposition responses. Direct evidence for this was obtained in experiments with fertilised flies, which, after ovipositing on liver, were kept in jars and fed on liver every second day; in some cases, eggs were laid at the time of the third meal (i.e., after two meals had been digested), but they were laid in response to indole only by flies that had received three meat meals since the last oviposition. This suggests that a diet rich in meat is necessary before a female will lay on substances other than carrion. The question why the flies oviposit on live sheep although they must find carrion on which to feed is discussed. Possibly gravid females are so numerous that they oviposit on carrion or on live sheep indiscriminately, or perhaps they are attracted to carrion for feeding and not for oviposition. Although females readily oviposit on carrion in cages, it does not necessarily follow that carrion is highly attractive to gravid females in the field.

Sinton (J. A.). A Report on the Provision and Distribution of Infective Material for the Practice of Malaria-therapy in England and Wales.—Rep. publ. Hlth med. Subj. no. 84, 22 pp., 1 pl., 22 refs. London, H.M.S.O., 1938. Price 6d.

A complete account is given of the routine procedure now employed at the laboratory of the Ministry of Health at Horton for the production and distribution of infective material (both blood and mosquitos) for use in the treatment of diseases by malaria therapy [cf. R.A.E., B 19 117]. The section on the preparation and distribution of intected mosquitos (pp. 11–19) deals with the supply of normal mosquitos, the technique of feeding them (including the choice of a suitable

patient and the method of feeding), the conservation and feeding of

the infected mosquitos and the transmission of infection.

The construction of a special laboratory in 1934 enabled a colony of Anopheles maculipennis race atroparvus, van Thiel, to be established [cf. 25 43], and this has flourished so that an ample supply of mosquitos is now available at all seasons, and only during winter, when extra numbers are needed for special experiments, are others caught in The first blood-meal taken by a newly emerged female is commonly small; for this reason the mosquitos are not usually fed on an infected patient until they have taken one or two blood-meals. generally on a rabbit. It is usual to feed them only on patients showing at least 5-6 exflagellating male gametocytes per 100 leucocytes (about 200 per cu. mm.) and in these cases 90-100 per cent. become infected after a single meal; if the gametocytes are less numerous, the number of mosquitos infected and the intensity of infection may be increased by a second or even a third feed upon the patient. mosquitos are kept at an average temperature of 75°F, and a humidity of 80 per cent. or over. Since 1932 they have been kept in large cages. in a specially heated incubation room; the rate of survival is about twice as great as it was when they were kept in small cages in an incu-In each cage, there is a compartment in which a rabbit or other animal, with a bare patch of skin on its back, is kept overnight. Thus the necessity for constantly handling the mosquitos in order to feed them is avoided, and they are left undisturbed from the time of their last infecting meal until they are removed to transmit the infection. Moreover, their opportunities for feeding last about 16 hours daily instead of 2, which was the maximum for those stored in an incubator. They are maintained continuously in the hot room and usually remain highly infective for about a month, after which time infection becomes less certain and a new, more recently infected batch is employed. only in special circumstances are they stored in a refrigerator. appearance of sporozoites in the salivary glands of mosquitos kept under the present laboratory conditions usually occurs in about 10 days. with Plasmodium vivax, 12 with P. falciparum and 15 with P. ovale. The primary attack in man usually takes place 1-3 weeks after the infecting feed.

SINTON (J. A.) & SHUTE (P. G.). A Report on the Longevity of Mosquitoes in relation to the Transmission of Malaria in Nature.—

Rep. publ. Hlth med. Subj. no. 85, 45 pp., 2 charts, 2 pp. refs. London, H.M.S.O., 1938. Price 9d.

One of the most important factors in the transmission of malaria is the length of life of the infected mosquito. Much information on this subject has been accumulated in the course of the routine work of providing infective females of *Anopheles maculipennis* race *atroparvus*, van Thiel, for the purpose of malaria therapy in England [see preceding abstract]. The data have been collected, analysed and compared with the results obtained in other countries, and where necessary they have been supplemented by further experimental investigations.

After discussing the age and origin of the mosquitos used, the authors compare the results of keeping the infected mosquitos in the incubator and in the hot room [loc. cit.]. The survival rates, based on the percentage alive on the day the sporozoites of Plasmodium vivax were first detected in the salivary glands, were far higher in the hot room,

and it is suggested that the most important of the factors to which this might be attributed are the longer and better opportunities for feeding, the elimination of unnecessary handling, and the larger and more airy room.

The normal span of life of female Anophelines in nature probably depends on the species or race of the mosquito and on the effects of its metabolic and biological activities, of meteorological conditions, and of endo-parasites, but possibly not those of human malaria. The information is discussed under these four headings, and conclusions are drawn from the available data. It appears that the theory that the harmlessness of certain species of Anopheles in nature depends on the shortness of their natural span of life, although attractive, does not afford a complete and reasonable explanation consistent with the known facts, at least so far as A. subpictus, Grassi, and A. vagus, Dön., are concerned. It is, however, possible that the natural longevity of other species may be of great importance in determining the degree of malaria transmission for which they are responsible. Under experimental conditions, atroparvus females collected in the field show great seasonal variations in expectation of life. The average survival rate is highest about September-October and lowest about May. These fluctuations, which are not apparent among mosquitos bred in the laboratory and kept at constant temperatures from the time of emergence, appear to be associated with changes in the bodily functions and behaviour of the insect at different seasons of the year [cf. R.A.E., B 18 32].

The blood meals taken at the end of August appear to be used mainly for the formation of fat reserves and to assist in tiding over the winter in a state of semi-hibernation. Such semi-hibernating females have an increased expectation of life because they live at a low temperature, their rate of metabolism is low and they have fat reserves for emergences, they are not subjected to the dangers of ovulation and oviposition, and they live in proximity to a suitable and ample food-supply. The survival rates fall as spring approaches, probably because of the increased age and weakness of the surviving mosquitos, which appear to be unable to withstand the strain of their renewed activities and die comparatively rapidly, so that by the middle of June they are replaced almost completely by the new-season adults. The expectation of life of these females is longer than that of the older, overwintered ones; thus the rate of survival begins to rise again, but remains lower than that of the winter generation because the mosquitos are subject to the dangers associated with ovulation and oviposition

and with the wanderings necessitated by these processes.

The duration of life of mosquitos is influenced by temperature, and it would appear that, as a rule, the higher the temperature, the shorter the expectation of life, probably owing to the greater metabolic and sexual activities that are stimulated by high temperatures. The optimum range of temperature appears to vary with the species of mosquito. The direct effect of humidity on longevity is usually greater than that of temperature; although higher temperatures cause increased multiplication in many species, the fall in relative humidity that accompanies the rise often causes a decrease in the numbers of adult mosquitos through its adverse effect on their survival. Although temperatures above about 61°F, are favourable for the development of the malarial parasites in the mosquito and the rate of development increases with the rise in temperature, unless the relative humidity

is favourable for the survival of the infected mosquitos, rises in temperature can have little effect in causing an increased rate of transmission.

No evidence was obtained from among healthy examples of race atroparvus infected with P. vivax and kept under conditions favourable to longevity that any noteworthy decrease in the length of life results from infection with Plasmodium. There is, however, a little evidence suggesting that severe infections may have some injurious effect, but that it is so slight that it can be detected only in mosquitos that are weakly or debilitated from some other cause. There is little to indicate that infection with Plasmodium causes any serious mortality among Anophelines in nature, and it does not afford a satisfactory explanation of the fact that some Anophelines are vectors whereas others are not.

Marshall (J. F.). **The British Mosquitoes.**—Super roy. 8vo, xi+341 pp., 20 pls., 172 figs., 208 refs. London, Brit. Mus. (Nat. Hist.), 1938. Price 20s.

The primary object of this comprehensive work, which replaces a handbook [R.A.E., B 8 139] now out of print, is to facilitate the identification of the British mosquitos. The number of species recorded has now increased to 29, and the species previously known as Anopheles maculi pennis, Mg., has been found to be composed of at least two races [cf. 22 228]. The preliminary chapters deal with means by which mosquitos may be recognised, with their classification and with their bionomics in general. Descriptions are then given of the external structures of all stages that are of importance in making generic and specific determinations, and of those internal organs of the female adult that are mentioned in the text in discussing such habits as pairing, feeding, etc. The subsequent chapters indicate the characters by which genera, subgenera and species of British mosquitos in all stages may be identified; they include keys to the genera and species in the adult and larval stages and a systematic description of each species, with notes on its bionomics, records of its occurrence in the British Isles and an outline of its distribution in other countries. Since eggs are difficult to obtain and the pupal stage is transitory, the characters by which species may be distinguished in these stages are considered to be of little practical interest, and the systematic descriptions have therefore been confined in most cases to the adult, male hypopygium and larva.

The paper concludes with a brief discussion of mosquito control in Britain, and general notes containing additional information on such subjects as the feeding of larvae and adults, oviposition, swarming, flight range, rarity, gynandromorphism, parasitism, fossil forms and malaria in Great Britain.

KARIADI (—). Oriënteerend filariaonderzoek te Martapoera (Res. Z/O. Afd. v. Borneo). [Exploratory Investigation on Filariasis at Martapoera in south-eastern Borneo.]—Geneesk. Tijdschr. Ned.-Ind. 78 pt. 19 pp. 1127-1138, 1 fig., 1 map, 7 refs. Batavia, 10th May 1938. (With a Summary in English.)

Martapoera, a locality on the river of the same name in southcastern Borneo, is surrounded by marshy land that is highly fertile, but abounds in breeding places for mosquitos, which during the rainy season are very troublesome. Mansonia uniformis, Theo., M. annulifera, Theo., and Anopheles barbirostris, Wulp, which are potential vectors of Filaria malayi, are common. Other species of Anopheles of which larvae were observed in June 1936 were A. kochi, Dön., A. vagus, Dön., A. hyrcanus var. sinensis, Wied., A. tessellatus, Theo., and A. leucosphyrus, Dön. Of 139 adults captured by day in a garden, 130 were M. uniformis and M. annulifera, while 89 adults of M. uniformis, 37 of M. annulifera and 2 of A. barbirostris were taken in an evening on a verandah. In a village near Martapoera, dissections of M. annulifera gave filarial infection indices of 21.7 and 5.2 per cent. in houses and gardens, respectively, the corresponding figures for M. uniformis being 5.9 and 0, and for A. barbirostris in houses 6.9. At Martapoera, 1 out of 7 individuals of M. annulifera captured in village houses was infected. It is very probable that M. annulifera is an important, if not the most important, vector of Filaria malayi. M. uniformis may also be important, because its numbers, which in gardens were on an average 15 times as great as those of M. annulifera, counterbalance the smaller infection index. In Celebes, F. malayi has been recorded as developing very well in A. barbirostris [R.A.E., B 25 232], and in investigations at Martapoera, 15 of 16 females of M. annulifera and all of 7 each of M. uniformis and A. barbirostris became infected when fed on a man harbouring microfilariae.

Large areas of water around Martapoera are covered with Eichhornia crassipes, and both Pistia stratiotes and Azolla are common. The author suggests that there is a relation between M. uniformis and Eichhornia and between M. annulifera and Pistia, so that M. annulifera possibly seeks not Eichhornia as the preferred "host plant," but rather Pistia or possibly yet other plants. Examination of the populations of nine villages near Martapoera gave filaria indices of 32·3, 27·1 and 11·8 per cent. for men, women and children, respectively. The frequency of occurrence of elephantiasis in this district is explained by the high filarial infection. The clinical symptoms as well as the species of mosquitos prevalent all indicated that the disease was caused by F. malayi. In the hilly areas, both the mosquito population and the filaria index are less, but malaria, probably transmitted by

A. maculatus, Theo., is common.

HODGKIN (E. P.). Naturalistic Methods of Malaria Control.—J. Malaya Br. Brit. med. Ass. 2 no. 1 pp. 24-29. Singapore, June 1938.

After briefly defining and discussing "naturalistic" methods of control, the author gives an account of their application against the Anophelines that transmit malaria in Malaya. Anopheles novumbrosus, Strickl. [cf. R.A.E., B 26 18] apparently breeds only in jungle and most frequently in swampy jungle such as that which covers extensive tracts of the coastal districts. The recognised means of preventing malaria transmission by this species is to keep all human habitations at a distance of half-a-mile or more from the edge of the jungle. The importance of A. umbrosus, Theo., as a vector has probably been over-estimated owing to its having been confused with A. novumbrosus, but it is still of considerable significance, especially in coastal districts. It prefers shade, avoids running water, and contrary to general belief, does not apparently breed in jungle. Measures for its control aim at

removing aquatic and overhanging vegetation from all actual or potential breeding places and confining water to definite channels in which it can flow freely. In Malaya, A. sundaicus, Rdnw., breeds only in salt water and as the complete exclusion of salt water is recommended as an agricultural measure and as an anti-malarial measure, the places where this species can breed are rapidly disappearing owing to the erection of bunds. The importance of A. barbirostris, Wulp, as a vector is difficult to assess. It breeds in almost any stagnant water containing a certain amount of vegetation and is not deterred by a moderate degree of salinity. Its control is closely bound up with that of the last two species, and on estates adjacent to settlements where malaria is hyperendemic, satisfactory control has been obtained by the exclusion of salt water, the provision of efficient drainage, and the elimination of excessive shade. A measure that might be of value in the settlements is that of "herbage cover" in which pools and drains are filled with cut vegetation [cf. 25 46, etc.]. A. maculatus, Theo., breeds in water that is being constantly renewed and is exposed to a certain amount of direct illumination. The measures against it include shading, making the water stagnant, increasing its rate of flow and eliminating side-pockets, periodical flushing, pollution, and the use of larvivorous fish.

Senior White (R.). On Malaria Transmission in the Jeypore Hills. Part II. A second Year's Results.—J. Malar. Inst. India 1 no. 2 pp. 129-145, 10 refs. Calcutta, June 1938.

An account is given of further work on the Anophelines concerned in the transmission of malaria in the Jeypore Hills, carried out in 1936–37, the results of which confirm and supplement those published in the first part of the paper [R.A.E., B 25 190]. Catches of adults of the more important species made in houses under conditions strictly comparable to those made previously in cattle sheds showed that the percentage of the group comprising Anopheles fluviatilis, James, A. varuna, Iyen., and A. minimus, Theo., is much greater in houses (58.1 as opposed to 4.1 in stables), with corresponding reductions in the percentages of A. culicifacies, Giles (from 60.2 to 38.5) and A. jeyporiensis, James (from 35.7 to 3.4). The results of a few precipitin tests indicate that A. fluviatilis and A. minimus are much less attracted to man for food than a comparison of catches in houses and stables would suggest. The low proportion (7 per cent. in houses) of A. culicifacies that had fed on man is consistent with its low occvst rate and the absence of sporozoites in it [cf. 25 191]. The only other species found to have fed on man was A. jeyporiensis. A. subpictus, Grassi, and A. vagus, Dön., whether resting in houses or stables, had invariably fed on animals. Anophelines caught in an experimental pigsty were few in number and species, which indicates that, in contrast to findings in Europe, pigsties are not attractive. The results of further dissections in villages in this area confirm those made in the previous year [loc. cit.]; sporozoites were found only in A. fluviatilis, A. varuna and A. minimus, the rates being 3, 4 and 4.1 per cent., respectively. The only other species infected was A. culicifacies, in which 2 out of 2,446 females showed oöcysts. As a result of the previous year's investigations, orders were given that, throughout the length of railway running through the Jeypore Hills, larval control measures were to be restricted to breeding places of A. fluviatilis, A. varuna and

A. minimus; this, together with "herbage packing" [cf. 25 46] of water courses in the post-monsoon period, when they are the chief breeding places of this group, has resulted in a saving of 77.9 per cent. in expenditure on larvicides, without any adverse effect on the health of the staffs at the 8 stations concerned. Counts of the oöcysts found in all gut infections in these three species during the two years showed that those in 95.8 per cent. of the mosquitos were "poor" [cf. 25 184]; in 75 per cent., the number of oöcysts was less than 6 per stomach. The period of non-transmission previously suggested [25 191] is too long; May and June are the only months in which no transmission occurs, even in the absence of perennial irrigation.

SWEET (W. C.), RAO (B. A.) & RAO (A. M. Subba). Cross-breeding of A. stephensi type and A. stephensi var. mysorensis.—J. Malar. Inst. India 1 no. 2 pp. 149–154, 1 pl., 3 refs. Calcutta, June 1938.

The following is taken from the authors' summary of the results of further cross-breeding experiments carried out with typical Anopheles stephensi, List., and var. mysorensis, Sweet & Rao [cf. R.A.E., B **26** 50]: In crosses in both directions, only small numbers of females laid eggs and still fewer laid viable eggs. It was possible to rear successive generations of hybrids from the viable eggs, but instances of the deposition of sterile eggs were observed in each generation. In the F₃ generation of typical females crossed with mysorensis males, most of the females laid hybrid eggs, some laid eggs of the type form, and a few laid eggs of the form of the variety. An F₄ generation produced by inbreeding the adults from the eggs of the mysorensis form was apparently a pure strain, but all the mosquitos died of cold before this could be definitely proved. Of 199 hybrid females of all generations and crosses, 14 had undeveloped ovaries, whereas no such ovaries were seen among 208 females of comparable ages from pure strains of both types. No undeveloped testes were found in 256 hybrid males.

Afridi (M. K.) & Majid (S. A.). Observations on the Range of Dispersion of Culex fatigans and its Infiltration into the Delhi Urban Area. Part I.—J. Malar. Inst. India 1 no. 2 pp. 155–167, 2 charts, 8 refs. Calcutta, June 1938.

In March 1937, in the course of the intensive anti-mosquito campaign that had been in progress in the Delhi Urban Area since 1936, it was found that a mosquito nuisance prevailed in the south-eastern section of New Delhi in spite of the vigorous control measures that had completely suppressed all possible Culicine breeding within the precincts of bungalows and in an area extending half a mile beyond the inhabited Repeated observations showed that throughout this period the nearest source of profuse Culicine breeding was the sewage farm previously incriminated [cf. R.A.E., B 23 19]. Details are given of trap catches of Culex fatigans, Wied., experiments with marked examples of this species and visual observations on mosquito flights, which showed that this farm was in fact the chief source of the nuisance. The longest distance travelled by a marked mosquito was more than three miles, and this mosquito was a female [cf. 23 79]. The effects of meteorological factors on the prevalence of C. fatigans, which are being further studied, are briefly discussed.

SENIOR WHITE (R.) & DAS (B. K.). On Malaria Transmission in the Singhbhum Hills.—J. Malar. Inst. India 1 no. 2 pp. 169–184, 1 map, 9 refs. Calcutta, June 1938.

The Singhbhum Hills are of great economic importance, for they contain the principal iron ore deposits of India and large deposits of manganese as well as other valuable minerals. A number of investigations on malaria have been carried out in this area since 1923, but in only one case were Anophelines examined for malaria parasites, and of the 556 females dissected all were negative except one example of Anopheles annularis, Wulp (fuliginosus, Giles), which harboured sporozoites. Since 1935, however, Anophelines collected in villages, mining camps, railway company's quarters, etc., have been dissected, and the results are given in detail in the present paper. They show that A. fluviatilis, James, A. varuna, Iyen., and A. minimus, Theo... are the only species that must be controlled to afford protection from malaria, and that A. culicifacies, Giles, which was previously assumed to be one of the most important vectors, need not be considered. It was found that transmission could occur in every month except May, June and July; the main transmission season is August-November. but in certain localities and years it probably extends until the time of great heat and low humidity in May. It is probable that transmission. at too low a rate to be detected in the numbers dissected, occurs in July also, and it would certainly be inadvisable for control operations not to be resumed as soon as the rains begin.

Afridi (M. K.), Majid (S. A.) & Singh (Jaswant). **Malaria in Kutch State.**—*J. Malar. Inst. India* 1 no. 2 pp. 187–213, 3 maps, 7 refs. Calcutta, June 1938.

Investigations on malaria were carried out in various typical localities in Kutch State, including both urban and rural areas and the Palace of the Maharajkumar in January, September and October 1937. Malaria was not found to be generally prevalent in the State, but in certain restricted areas the incidence was high. The Anophelines collected were Anopheles culicifacies, Giles, A. stephensi, List., A. subpictus, Grassi, A. fluviatilis, James, A. turkhudi, List., A. annularis, Wulp, and A. barbirostris, Wulp. Notes are given on their breeding places and breeding habits. Dissections of the first two species showed only A. stephensi to be infected. Its preferred breeding places were troughs, reservoirs and wells in the grounds of the Palace and wells almost exclusively in the City of Bhuj. An outline is given of the measures recommended for the control of the larvae; these included the employment as a larvicide of petrol, which is cheap, and the use of Gambusia affinis in wells, reservoirs and ornamental waters.

MITRA (K.). Increase of Malaria in Manbhum, 1936 (Abstract).—

J. Malar. Inst. India 1 no. 2 pp. 215-216, 1 ref. Calcutta, June 1938.

There was a severe outbreak of malaria in certain parts of the district of Manbhum, Bihar, in 1936, and a brief survey was carried out in March 1937. Malaria exhibits a definite seasonal incidence in this district; an autumn wave with its peak in November begins in July, a month after the onset of the rains, and there is also evidence of a

spring wave with its peak in April and May, but this is less well marked. The Anophelines recorded were Anopheles culicifacies, Giles, A. annularis, Wulp, A. pallidus, Theo., A. vagus, Dön., A. fluviatilis, James, and A. jeyporiensis, James.

Wats (R. C.) & Bharucha (K. H.). Larvicides for Antimosquito Work, with special Reference to Cashew-nut Shell Oil (Abstract).— J. Malar. Inst. India 1 no. 2 pp. 217-219. Calcutta, June 1938.

Laboratory experiments were carried out in Bombay on larvae and pupae of Armigeres obturbans, Wlk., in an attempt to discover a cheap and efficient larvicide. A number of substances were tested, using a technique that is described. The mortality observed at intervals after application was compared with that effected by kerosene. The only satisfactory results were obtained with a mixture of 2 parts cuprous cyanide and 98 parts powdered soapstone, which killed almost all the larvae and pupae when applied at the rate of 1 gm. per sq. ft. of water surface and with a 2 per cent. mixture of cashew-nut shell oil in kerosene. Cashew-nut shell oil, which is cheap, is a viscous, tarry oil obtained from the charred pericarp of the fruit of the cashew tree (Anacardium occidentale) as a by-product in the preparation of the nuts. The mixture killed almost all the larvae and pupae within two hours when used in the laboratory at the rate of 1 cc. per sq. ft. When applied at the same rate to water in a cistern with an area of 44 sq. ft., a 5 per cent. mixture was necessary to produce similar results. The amount of pure kerosene necessary to give 100 per cent. mortality was 2.5-3 cc. per sq. ft. In further experiments, in which the 5 per cent. mixture was applied at the rate of 1 cc. per sq. ft. to 3 wells 11, 15 and 25 feet in diameter and at the rate of 1.5 cc. per sq. ft. to a drain 50 feet long and 10 feet broad (part of a sewer) in which the water had a slight flow and was covered with a thick scum, no living larvae were found two hours after application. When 1 per cent. stearic acid was dissolved in the kerosene before the cashew-nut shell oil was added, the stability of the film was increased and it was less easily broken by wind. Cashew-nut shell oil may also be diluted with heavy oils instead of kerosene; "High Speed Diesel Oil" gave the best results in preliminary experiments. The disadvantages of the mixture as a larvicide for general use are that it does not retain its effectiveness, so that it must always be freshly prepared before use, the cashew-nut shell oil from different sources differs in toxicity, presumably owing to adulteration, and it is an irritant when applied to the skin.

DE MELLO (I. F.). La campagne anti-malarienne dans les régions rurales de l'Inde portugaise.—Riv. Malariol. 17 pt. 3 pp. 208–224. Rome, 1938. (With a Summary in Italian.)

In this review of the present status of malaria in Portuguese India, the author states that in towns the incidence of the disease has steadily decreased owing to improvements in living conditions, hygiene and sanitation, but that in rural areas, where little work on its elimination can be undertaken, owing to the magnitude of the problem, and where control measures must perforce be confined to medical treatment, endemic malaria has led to some diminution in population.

A list is given of the Anophelines of Portuguese India; it comprises the species noticed in previous papers [R.A.E.] B **22** 240; **23** 287]

except Anopheles varuna, Iyen. The habitat of the vector species varies according to localities. For instance, A. stephensi, List., is domestic at Nova Goa, but breeds in wells at Damaun and at the edge of rivers at Praganã. A. fluviatilis, James (listoni, List.), which breeds in disused wells at Damaun and Old Goa and in excavations at Diu, is the chief vector in the district of Novas Conquistas, where the larvae abound in puddles formed on river banks by the bare roots of aquatic plants. A culicifacies, Giles, breeds at the edge of canals and small streams.

Tilli (P.). Le moderne tecniche agricole impongono l'estensione della disanofelizzazione con calciocianamide. [Modern agricultural Practices demand an Extension of anti-Anopheline Work with Calcium Cyanamide.]—Riv. Malariol. 17 pt. 3 pp. 225–230, 3 figs., 6 refs. Rome, 1938. (With a Summary in French.)

In various dry regions of the United States, powerful lister ploughs are employed with an attachment that makes dams in the furrow to form basins in which rainfall accumulates. The use of such dams has now been adopted in Tripolitania, but involves the danger of re-establishing the marshy Anopheline breeding places eradicated by drainage. The author suggests that the larvae could be destroyed by using calcium cyanamide [cf. R.A.E., B 21 275; 23 204; 25 194], which would at the same time supply a necessary manure.

Peragallo (I.). Un catturatore trasparente delle zanzare. [A transparent Catcher for Mosquitos.]—Riv. Malariol. 17 pt. 3 pp. 231–234, 1 fig. Rome, 1938. (With a Summary in French.)

It is proposed to employ youth organisations in Italy to catch Anophelines resting on the walls and ceilings of rooms. The authorities propose that the mosquitos be caught in a metal funnel at the bottom of which is a plug of cotton-wool soaked in kerosene to disable or kill them. The author has improved the design by mounting two funnels of transparent cellulose plastic material at a right angle on the end and side of a stick. Each funnel is 4 ins. in diameter and $2\frac{1}{4}$ ins. deep in the experimental model, but a greater depth is desirable. In each, there is a plug of cotton-wool soaked in kerosene. The cost is less than for metal, and the captured mosquitos are visible.

Callot (J.). Contribution à l'étude des moustiques de Tunisie et en particulier du sud de la régence.—Arch. Inst. Pasteur Tunis 27 no. 2 pp. 133-183, 4 figs., 3 pp. refs. Tunis, June 1938.

In this account of the mosquitos of Tunisia, which is based chiefly on the collection and rearing of larvae from more than 75 breeding places, keys are given where necessary to the subgenera and species in various stages, and notes under each species deal with such points as morphology, distribution, habits and breeding places. The only Anopheline that has not been mentioned in a recent paper [R.A.E., B 23 188] is Anopheles coustani var. ziemanni, Grünb., which has not been found since it was first recorded by Séguy from Djebel Bou-Hodna. A table shows the larval associations observed by the author in different localities of the Nefzaoua and Tataouine regions in September—October 1937. In a discussion of the Anopheline breeding places in (2522) [8]

the latter region, the author points out that malaria exists only at places where there are permanent natural waters, such as streams, pools and springs. There is no endemic malaria in localities where there are only wells that are constantly in use, and, although cisterns are numerous, they are well-constructed and carefully maintained and no larvae were found in them.

Shields (S. E.). **Tennessee Valley Mosquito Collections.**—*J. econ. Ent.* **31** no. 3 pp. 426–430, 2 refs. Menasha, Wis., June 1938.

Notes are given on the seasonal prevalence and breeding places of 35 species of mosquitos collected in the Tennessee Valley between 34°40′ and 36°35′ N. lat. during the years 1934, 1935 and 1936. The Anophelines were *Anopheles punctipennis*, Say, and *A. quadrimaculatus*, Say, which were both found throughout the area, *A. crucians*, Wied., *A. barberi*, Coq., and *A. walkeri*, Theo.

LAAKE (E. W.) & SMITH (C. L.). The Hydrogen-ion Concentration of Myiotic Wounds in Sheep and Goats,—J. econ. Ent. 31 no. 3 pp. 441–443, 1 ref. Menasha, Wis., June 1938.

The hydrogen-ion concentration in wounds in guineapigs infested with Cochliomyia hominivorax, Coq. (americana, Cush. & Patt.) and its relation to the stimulation of oviposition in gravid females of this fly were discussed by the senior author in a paper read at the 33rd Annual Meeting of the American Society of Tropical Medicine. The mean pH of wounds in guineapigs having lethal and sublethal infestations indicated a significant increase in alkalinity on the third day of myiasis. During the remainder of the period of infestation, the alkalinity diminished only slightly in animals having lethal infestations, but more markedly in those having sublethal ones. During the period after infestation, the mean pH changed to the acid side in all animals that survived and remained on the alkaline side in those that succumbed. A positive relationship between the period of greatest attractiveness of wounds to gravid females and that of maximum alkalinity of wound

exudates was clearly indicated.

The present paper gives the results of an investigation on the pH of exudates of 32 wounds in 16 goats and 20 wounds in 10 sheep, all infested with larvae of C. hominivorax. The wounds were made in the rump, one on each side, and about 100 first-instar larvae were implanted in each. A comparison of the graphs obtained showed that the general trends of the mean pH course were similar except that changes occurred sooner in goats than in sheep. The period of infestation was practically the same in both (about 7½ days). The alkalinity was comparatively high from the third to the sixth day. This period is longer and the peak of alkalinity higher than in wounds in guineapigs. In the period after infestation had ceased, the course of the mean pH in wounds in goats tended towards greater acidity as long as pus was present, whereas in sheep it was alkaline or nearly alkaline for the entire period; it is therefore reasonable to assume that at this time wounds in sheep are more attractive than those in goats. In the field, it has been observed that wounds producing a watery discharge do not heal promptly and are exceedingly attractive to gravid blowflies for long periods, whereas wounds filled with a viscous discharge form scabs quickly and are much less attractive. In

experiments with guineapigs it was found that wounds discharging watery fluid were definitely alkaline, whereas wounds of the other type were generally acid in reaction. The information obtained should be of value as a guide to the selection of chemicals to be tested as larvicides, ovicides and repellents, and it also indicates that wounds taking a long time to drain and heal should be acidified by local or internal medication.

[SERGIEV (P. G.) & KOVTUN (A. S.).] CEPTURE (П. Г.) И КОВТУН (A. C.). Organisation de la lutte contre le paludisme en l'URSS vers le vingtième anniversaire de la révolution d'octobre. [In Russian.]—Med. Parasitol. 6 no. 6 pp. 723-755. Moscow, 1937.

This is a survey of the work carried out in the Russian Union since 1921 for the control of malaria, including the measures employed against Anophelines. Oiling of the breeding places, which was started on a large scale only in 1934, has been found too expensive, and dusting with Paris green and other arsenicals, both from aeroplanes and from the ground, is being gradually substituted for it, vast expanses of swamps, flooded areas and rice-fields being thus treated yearly. The introduction of Gambusia in the Caucasus, Central Asia and southern Ukraine has given very successful results. The destruction of adult Anophelines hibernating in buildings has proved of little value, since large numbers of them overwinter in inaccessible places out of doors. Attention has therefore been directed to the use of dusts and sprays against mosquitos present in inhabited houses in summer. Houses have been screened in districts in which large expanses of water render the application of anti-larval measures impossible or uneconomic, and the use of mosquito nets is encouraged. Since 1932, reclamation work of various kinds has been carried out, and the irrigation system in the cotton-growing areas has been improved.

[Pirumov (Kh. N.).] Пирумов (X. H.). Résultats sommaires de l'étude des maladies tropicales dans la République Soviétique Socialiste d'Arménie. [In Russian.]—Med. Parasitol. 6 no. 6 pp. 756-770, 84 refs. Moscow, 1937.

Investigations in the course of the last 15 years have shown that 17 of the 28 districts into which Armenia is divided are endemic foci of malaria. The spleen index is less than 15 per cent. in districts at altitudes of about 4,000 ft. or more, 15-40 per cent. in 7 districts in the foot-hill region of the mountains at altitudes of 2,100-4,200 ft., and 70-80 per cent. in 6 districts situated at altitudes of 1,800-3,300 ft., with an average annual temperature of 10-11°C. [50-51.8°F.], a relative humidity of 40-70 per cent. during the warm months, and numerous natural swamps. Of the five species of Anopheles that occur in Armenia, A. maculipennis, Mg., is ubiquitous and occurs at altitudes of up to 6,600 ft.; in low-lying districts, it represents 95-99 per cent. of all the Anophelines present. The local distribution of its different races has not yet been ascertained, but maculipennis (typicus) predominates in some districts and sacharovi, Favr, is abundant in one locality. A. superpictus, Grassi, and A. hyrcanus, Pall., come second and third in abundance, the latter occurring in rice plantations and natural swamps. Anopheles claviger, Mg. (bifurcatus, auct.) and A.

plumbeus, Steph., are of limited distribution. Reference is made to successful experiments on the control of Anopheline larvae in rice-

fields by interrupted irrigation [cf. R.A.E., B 19 154].

A list is given of the species of *Phlebotomus* found in Armenia; in addition to those already recorded [23 3], they include *P. sergenti*, Parr., and *P. perfiliewi*, Parr. Dermal leishmaniasis has not been observed in the republic, but visceral leishmaniasis occurs in children and dogs. The affected districts are within the range of distribution of the sandflies, and *P. papatasii*, Scop., and *P. caucasicus*, Marz., have been found in all of them. Sandfly fever is endemic in a number of low-lying districts.

Investigations since 1933 have shown that tick-borne relapsing fever occurs in Armenia and that the jerboa, Alactaga elater, is a natural reservoir of the disease. Unidentified ticks of the genus Ornithodorus infected with spirochaetes have been found in burrows of rodents in several districts and transmitted the spirochaetes to laboratory animals. O. lahorensis, Neum., however, which occurs in cattle sheds in low-lying as well as mountainous localities, did not transmit relapsing fever experimentally.

[Pikul' (I. N.) & Chatkin (V. I.).] Пикуль (И. Н.) и Чайкин (В. И.). Cinq années de travail pour l'abaissement du paludisme au Daghestan. [In Russian.]—Med. Parasitol. 6 no. 6 pp. 771-781, 3 graphs. Moscow, 1937. (With a Summary in French.)

Malaria used to be severe in Daghestan, but a marked decrease in its incidence has taken place since 1932 owing to the extensive organisation of quinine prophylaxis and treatment of infected persons, screening, the use of mosquito nets, and the control of Anopheline larvae by drainage, clearing of irrigation ditches, reclamation of vast areas of land and the systematic application of larvicides. As a result, the oöcyst and sporozoite indices of Anophelines decreased in some areas from 48 per cent. in 1933 to 12 per cent. in 1934. Large expanses of water near rivers, however, still provide favourable breeding places for Anopheline larvae in a large part of Daghestan, and the necessity of eradicating them is emphasised.

[Dzhaparidze (P. S.).] Джапаридзе (П. С.). Dynamique du paludisme en Abkhazie durant les dernières années et les voies à suivre pour la liquidation. [In Russian.]—Med. Parasitol. 6 no. 6 pp. 782-793. Moscow, 1937.

In the coastal part of Abkhazia, Anophelines breed in large swamps resulting from the flooding of the rivers in the spring, as well as in numerous natural and artificial water reservoirs and small streams in the foothill region. The species in descending order of importance as vectors of malaria are Anopheles maculipennis, Mg., A. claviger, Mg. (bifurcatus, auct.) and A. plumbeus, Steph., all of which are widely distributed, and A. hyrcanus, Pall., which occurs in small numbers in two districts only. Intensive anti-malaria work consisting chiefly in organised medical treatment of the population, has been carried out since 1930. As a result, the number of new cases has decreased every year and many localities may now be considered free from malaria. The introduction of Gambusia has proved to be of great value [cf.]

R.A.E., B **22** 193], the fish becoming established and greatly reducing the numbers of mosquito larvae. A brief programme for further anti-malaria measures is outlined.

[Веклемізнеч (V. N.) & Zhelokhovtzev (A. N.).] Беклемишев (В. Н.) и Желоховцев (А. Н.). La répartition géographique d'Anopheles maculipennis Meig. et de ses sous-espèces dans l'URSS. [In Russian.]—Med. Parasitol. 6 по. 6 pp. 819-835 4 maps, 41 refs. Moscow, 1937. (With a Summary in French.)

The authors divide the 13 races of Anopheles maculipennis, Mg., into five groups, comprising, respectively: messeae, Flni., melanoon, Hackett, and subalpinus, Hackett & Lewis; maculipennis (typicus): atroparvus, van Thiel, labranchiae, Flni., pergusae, Miss., sicaulti, Roub., fallax, Roub., and cambournaci, Roub. & Treill.; sacharovi, Favr; and occidentalis, D. & K., and aztecus, Hffm. This grouping is almost similar to the division of the races into geobiotypes suggested by Diemer and van Thiel [R.A.E., B 24 286], with the difference that sacharovi is now excluded from the geobiotype atroparus-labranchiae, since their areas of distribution overlap. The authors are inclined to regard race subalpinus [24 36] as not distinct from melanoon.

The geographical distribution of *A. maculipennis* is briefly reviewed; it is pointed out that it is a holarctic species, the area of its occurrence forming an almost complete circle, which is, however, broken in the eastern part of Asia [cf. 25 145] and almost broken in the eastern half of North America. The northern and southern boundaries of its range are primarily determined by lack or excess of warmth in summer.

The following is chiefly taken from the authors' summary of the distribution of the individual races, particularly in the Russian Union: Of all the races, messeae is the most widely distributed, occurring in practically the whole of Europe (with the apparent exception of Spain) and the whole of Siberia. It is the only race found in central and eastern Siberia. In the south, it occurs in Kazakstan and Kirghizia as far as the northern slopes of the Kirghiz mountains, but it is completely absent from Turkmenistan. Its presence in Transcaucasia is doubtful, though it is common in the northern Caucasus as far as the rivers Terek and Kuban.

Race melanoon has been recorded from Spain, Italy, the Balkans and the Black Sea coast of the Caucasus, and eggs of the type of subalpinus, which has a rather similar distribution [24 36], have also

been found in the Caucasus.

Race maculipennis (typicus) occurs over almost the whole plain of eastern Europe as far as the Ural mountains, but not in the Province of Orenburg. It has occasionally been found in western Siberia and in the foot-hills of the Altai mountains. It decidedly predominates in the Caucasus, except in low-lying places; it is the only race that occurs in the mountains, but it is absent from the steppes in the south. It has also been found in the mountains of Kopet-Dag in south-western Turkmenistan, but appears to be absent from the rest of the country.

The wide distribution of this race from north to south may be explained by its two modes of hibernation, since in the north the females overwinter (like *messeae*) in cold shelters in the absence of hosts, whereas in the south they congregate, like *labranchiae* or *atroparvus*, in shelters containing hosts and are in the state of gonotrophic

dissociation.

Of the group atroparvus-labranchiae, only atroparvus has been found in the Russian Union. It occurs in the basin of the river Dniester, along the Dnieper from the mouth to the town of Orsha, in southern Ukraine, in the steppes of the northern Caucasus and along the northern coast of the Black and Azov Seas. The larvae develop in both fresh and brackish water, and their occurrence in some localities in brackish water only is probably chiefly due to competition in fresh water by messeae and maculipennis (typicus). The north-eastern boundary of atroparvus in the Russian Union approximately coincides with the January isotherm of -7° C. [19.4°F.] and its absence further north may be explained by the fact that it cannot survive low temperatures in hibernation.

Race sacharovi occurs over a considerably larger territory than atroparvus, being found in the eastern half of the Mediterranean area in countries with a continental climate and high summer temperatures. In the Russian Union it is present over a large part of the Caucasus, but is absent from Lenkoran on the Caspian Sea and from the Black Sea coast, probably owing to the humid climate there. It is common in the Ferghana valley, in the district of Tashkent, and along the river Amu-Dar'ya to the mouth, being the only race found in Central Asia, except in the mountains of Kopet-Dag where typical maculipennis also occurs.

The races of the *occidentalis* group have only been recorded from North America.

[SMIRNOV (E. S.).] CMUPHOB (E. C.). Résultats sommaires du travail du laboratoire dans sa lutte contre les mouches. [In Russian.]—Med. Parasitol. 6 no. 6 pp. 872–879, 13 refs. Moscow, 1937.

A special laboratory for the study of flies that live in association with man has been established at the Tropical Institute in Moscow, and a survey is given of the results of investigations carried out by workers attached to it, most of which have already been noticed [R.A.E., B 22 166, 216, 256; 23 109, 110; 24 71, 72; 25 111; 26 167]. A preliminary account is given of experiments on the attractiveness to Musca domestica, L., of different kinds of dung; they were carried out by O. S. Kuzina and are the subject of a subsequent paper [26 242]. It was also found that besides manure, kitchen refuse is an important breeding place of M. domestica, especially in towns. Observations showed that the flies are active by night as well as by day; in warm rooms they were caught in traps in darkness at night. Few flies, however, entered buildings that were dark.

In the course of extensive investigations on blowflies by M. S. Vladimirova, it was found that though *Phormia terraenovae*, R.-D. (groenlandica, Zett.) was the chief species that visited baits of meat exposed in the open air, it seldom oviposited on them, and its larvae occurred chiefly in kitchen refuse. Calliphora uralensis, Villen., C. erythrocephala, Mg., and different species of Lucilia, of which six were observed near Moscow, also readily visited the meat, and all of them oviposited on it except C. uralensis, the eggs and larvae of which occurred in great numbers in faeces in latrines. M. domestica was never attracted to the baits, though its larvae were successfully reared on meat. The meat baits usually became overcrowded with larvae of flies, and as result of competition only an insignificant percentage of them survived.

[Moshkovskii (Sh. D.), Demina (N. A.), Nosina (V. D.), Pavlova (E. A.), Livshitz (I. M.), Pel's (G. Ya.) & Rubtzova (V. P.).] Мошковский (Ш. Д.), Демина (Н. А.), Носина (В. Д.), Павлова (Е. А.), Лившиц (И. М.), Пельс (Г. Я.) и Рубцова (В. П.). La transmission du virus de la fièvre pappataci par les phlébotomes éclos des oeuss pondus par les femelles infectées. [In Russian.]— Med. Parasitol. 6 no. 6 pp. 922-937, 1 diagr., 5 graphs. Moscow, 1937.

Details are given of experiments to determine whether the virus of sandfly fever can be transmitted hereditarily in Phlebotomus papatasii, Scop. [cf. R.A.E., B 11 61; 12 24]; they were carried out in Moscow in 1937, using larvae and adults reared from eggs laid by females that had been collected in an endemic locality and had been allowed to feed one or more times on infected persons. The experiments with the larvae, suspensions of which were inoculated subcutaneously into two volunteers, gave inconclusive results, but when the newly emerged females were allowed to feed repeatedly at intervals of 2-3 days and a temperature of 25-28°C. [77-82·4°F.] on 22 men who had never suffered from the disease, three of the latter developed typical clinical symptoms of sandfly fever, and the serum from their blood, taken at the onset of the fever, proved to be virulent. The number of sandflies that fed on them varied from 250 to 450. Later, the authors were informed that two more persons had contracted the disease after sandflies of the same origin as those used in the experiments had fed on them. In one of these cases, the infection resulted from the bites of females that had just emerged, which disproves the suggestion that the virus is only transmitted after the sandfly has already digested a feed of blood [11 61].

[VAINSHTEIN (N. B.).] Вайнштейн (Н. Б.). Changements saisonniers de la fécondité de l'Anopheles maculipennis messeue dans les conditions d'Astrakhan. [In Russian.]—Med. Parasitol. 7 no. 2 pp. 208-211, 1 graph. Moscow, 1938. (With a Summary in French.)

Laboratory observations on the oviposition of Anopheles maculi pennis, Mg., race messeae, Flni., were carried out in Astrakhan from 15th October 1936 to 15th September 1937, during which period 765 batches of eggs were obtained from 1,300 females. In the winter, the mosquitos were collected twice a month in hibernation quarters, fed on a rabbit and kept at 20-25°C. [68-77°F.] and a relative humidity of 90 per cent. In the summer, females that had already fed were caught in day-time shelters. Counts of the eggs deposited showed that the number in a batch gradually increased as spring approached. In December-May the second batch of eggs was usually much smaller than the first. The average total number of eggs laid by overwintered females in May was 196. The average total number per female in summer decreased gradually from 200 in June to 153 in September. These figures are based on the females that oviposited, but the percentage that did so also decreased gradually from 79 in June to 32 in September. Though messeae was the predominant race of A. maculipennis observed in Astrakhan, 10 of the batches of the eggs laid were those of race maculipennis (typicus) and 2 those of atroparvus, van Thiel, which has not previously been recorded in Astrakhan.

[VAL'KH (S. B.).] Banda (C. E.). Some Data regarding Anopheles bifurcatus in the Donetz Region of the Ukrainian SSR and its epidemiologic Significance. [In Russian.]—Med. Parasitol. 7 no. 2 pp. 212–213. Moscow, 1938.

Anopheles claviger, Mg. (bifurcatus, auct.) is not considered of importance as a vector of malaria in the Ukraine, because it seldom comes in contact with man. In September 1934, however, it was found to attack man very readily and in large numbers in a wood of deciduous trees near the town of Artemovsk in eastern Ukraine that is constantly visited by people. During the day, the adults sheltered on the lower branches of felled trees, in dense shrubs and among the thin entangled rootlets exposed in depressions in the soil. They were never found in an inhabited house near the wood, in which A. maculipennis was invariably present. The larvae occurred in a brook, a swamp fed by a spring and a pond, the water being in all cases shaded by trees. They successfully overwintered in the laboratory at an air temperature that fluctuated between -2.5 and 10°C. [27·5–50°F.], and the adults emerged from 17th April (at 17·5°C. [63.5°F.]) to 2nd May. In the district of Artemovsk, A. claviger has been found in many localities, and in two instances adults were taken in dwellings. It is concluded that, under conditions similar to those described, this species may become an important vector of malaria, and the possibility that it may be favoured by the planting of vegetation on the banks of water as a measure against A. maculipennis [R.A.E., B 24 227] should be investigated.

[Vaĭnshtein (N. B.).] Вайнштейн (H. Б.). Résultats de l'épreuve de la propriété larvicide du vert de Schiolkovo. [In Russian.]—Med. Parasitol. 7 no. 2 pp. 214-215. Moscow, 1938. (With a Summary in French.)

In the summer of 1937, field experiments were carried out near Astrakhan to test the effectiveness against Anopheline larvae of dusting with Shchelkovo green. This is a preparation of gypsum and Paris green containing 31.9 per cent. arsenic trioxide, 18 per cent. copper oxide, 5.3 per cent. acetic acid and 7.3 per cent. water. The breeding places treated differed in size and in the type of vegetation that covered them. In comparative experiments, the new larvicide and Paris green were both mixed with kieselguhr at the rate of 3:7; both mixtures were applied to the same types of breeding places at the rate of 0.9 lb. per acre and both gave complete mortality of the larvae of all instars. The mixture containing Shchelkovo green also killed all larvae in 6 hours when applied at the same rate from an aeroplane over a total area of over 5,000 acres. The aeroplane flew at a height of about 8 ft., and the mortality of larvae in dishes placed on the ground at right angles to the line of flight showed that an effective amount of dust was deposited over a width of 330 ft. Shchelkovo green is so finely ground that larvae of the first instar were killed in 2-4 hours.

[Kuzina (O. S.).] Kyshha (O. C.). The Choice of Egg-laying by the House Fly (Musca domestica L.). [In Russian.]—Med. Parasitol. 7 no. 2 pp. 244–257, 3 graphs, 2 diagr., 13 refs. Moscow, 1938. (With a Summary in English.)

In experiments in Moscow to determine the comparative attractiveness to Musca domestica, L., of different kinds of dung, equal amounts

of the kinds to be tested were placed in wire cages containing reared flies, and the number of times each kind was visited by flies in given units of time was recorded. The numbers of eggs deposited were also counted. In experiments with fresh material, 70.70, 23.83 and 5.47 per cent. of the visits were to horse, pig and cow dung, respectively. Horse dung, however, had practically lost its attractiveness on the second day; it became mouldy in 3-5 days and entirely lost the odour of ammonia. Old pig dung that had been kept in a covered container at 25 or 40°C. [77 or 104°F.] for 5–19 days (in most cases for 5–7 days) was, on the contrary, definitely preferred to fresh horse or cow dung. the percentage of visits being 72.16, 24.32 and 3.52, respectively. Pig dung kept in an air-tight container at 25°C. retained its attractiveness for up to 36 days, but when exposed it rapidly lost its attractiveness; thus, when compared with fresh pig dung, it received only 13.5 per cent. of the visits on the 9th day, and 3 per cent. on the 18th. The newly emerged females were not attracted by dung, but visited it more and more often as their ovaries matured. The number of visits reached its maximum on the fifth day, when the first batch of eggs was laid, after which it dropped sharply. In most cases, the eggs were deposited on the kind of dung that was visited most frequently. The females alighted on dung or milk for feeding 5.88 and 2.28 times as often, respectively, as the males, evidently because they require additional nutrition for the maturation of eggs. Special experiments, the technique of which is described, showed that the number of females visiting a given quantity of dung is inversely proportional to its distance from them.

[Krasikova (V. I.).] **Красикова (В. И.). Éclosion d'**Anopheles maculipennis dans les cuves de bois. [In Russian.]—Med. Parasitol. 7 no. 2 pp. 260–261. Moscow, 1938.

In a village in the Province of Kuĭbuishev, fourth-instar larvae and pupae of Anopheles maculipennis, Mg., were found in September 1937 in a large wooden vat containing over 80 cu. ft. water. The vat had been filled from a spring some three months previously, and fresh water from the same source had been added to it every 5–7 days. Oviposition had probably taken place on the water in the vat, as no eggs, larvae or pupae of A. maculipennis were found in the spring during the summer. The water in the vat was soft and neutral (pH $7\cdot2$); it had a high content of dissolved oxygen, indicating the presence of a large amount of organic substances of vegetable origin soluble in water, and was free from decomposing organic matter of animal origin. Large vats of this kind are kept in villages for the use of fire brigades and should be inspected when surveys of the possible breeding places of A. maculipennis are made.

[Krasikova (V. I.).] Красинова (В. И.). Détermination rapide du dessin des oeufs d'Anopheles à l'aide d'une loupe-lunettes. [In Russian.]—Med. Parasitol. 7 no. 2 pp. 261–262, 1 fig. Moscow, 1938.

For a rapid identification of the pattern of Anopheline eggs under field conditions, the use is recommended of a magnifying glass set in an ordinary spectacle frame, the other lens of the spectacles being replaced by a light metal plate. [Vaĭnshteĭn (N. B.).] Вайнштейн (H. Б.). Sur la présence de l'Anopheles maculipennis atroparvus aux environs d'Astrakhan. [In Russian.]—Med. Parasitol. 7 no. 2 p. 262. Moscow, 1938.

Two females of Anopheles maculipennis, Mg., taken in July 1937 in a cow-shed in a village on the left bank of the Volga east of Astrakhan laid 507 eggs, all of which showed the characters of race atroparvus, van Thiel. This race has not previously been recorded from the delta of the Volga.

[Pokrovskii (S. N.) & Zima (G. G.).] Покровский (С. Н.) и Зима (Г. Г.). Mouches comme transporteurs des oeufs des helminthes dans les conditions naturelles. [In Russian.]—Med. Parasitol. 7 no. 2 pp. 262–264. Moscow, 1938.

To determine to what extent flies are responsible for the dissemination of helminths, 2,652 individuals, caught in Stalingrad, chiefly in food shops and also in vegetable stores, latrines, stables and the laboratory, were dissected and their legs, proboscis and wings, as well as the contents of their digestive tract, examined. Of the flies taken, 2,531 were Musca domestica, L., 34 Lucilia sp., 34 Stomoxys calcitrans, L., 22 Sarcophaga sp., 17 Muscina stabulans, Fall., and 14 Calliphora sp. Eggs of helminths were found on 11 examples of Musca, 4 of Lucilia, 2 of Sarcophaga and 1 of Calliphora, those of Hymenolepis, Enterobius vermicularis and Diphyllobothrium being found most frequently. In most cases, the eggs were on the legs, considerably less often in the digestive tract and in one case only on the wings. The percentage of flies carrying the eggs was highest (0·47) among those taken in food shops, and careful protection of foodstuffs from flies is therefore recommended.

MILLER (A. C.) & SIMANTON (W. A.). Biological Factors in Peet-Grady Results.—Soap 14 no. 5 pp. 103, 105, 107, 109, 111, 113, 5 diagr., 4 refs. New York, N.Y., May 1938.

SIMANTON (W. A.) & MILLER (A. C.). Greater Speed and Accuracy with modified Peet-Grady Method.—T.c. pp. 115, 117, 2 refs.

Details are given in the first paper of investigations carried out on house-flies (Musca domestica, L.) to obtain additional information on the biological factors that influence the results of tests made by the Peet-Grady method [cf. R.A.E., B 16 255], which was adopted in 1932 by the National Association of Insecticide and Disinfectant Manufacturers as the official method for evaluating liquid household insecticides in the United States. The susceptibilities to sprays containing increasing concentrations of pyrethrins differed in successive batches of flies from a single stock cage, and the order of susceptibility of the different batches changed at different concentrations, even though the figures had been adjusted to a 50:50 sex ratio. It is therefore suggested that a truer evaluation would be obtained if it were based on an average from tests on several cultures rather than tests on a single culture, and the number of cultures to be used might be specified. No data are available on the relative susceptibilities of various portions of a given culture after sex susceptibility has been

taken into account, and care should therefore be taken that the flies in a given series of tests are representative of the whole of the culture used.

Males and females have been found to differ in susceptibility [cf. 26] 86], but there is no assurance that the differences are uniformly related in different cultures, and tests showed that they may vary at different concentrations of insecticides. Adjustment of the mortality to a 50:50 sex ratio by adding one half the percentage mortalities of males and of females provides a means of expressing insecticidal efficiency of a sample as a single figure, but involves counting the numbers of the two sexes, a procedure that could be avoided if it were possible to breed batches containing 50 per cent. males. Sex counts of all flies emerging from each of 11 culture jars selected at random showed the mean percentage of males to be 51.4, but the percentage in successively emerging portions of a culture decreased from about 65 in the first tenth to 40 in the last tenth; thus if all the flies from a culture jar, rather than only a portion of them, were transferred to a stock cage, the ratio would be about 50:50. A comparison of jars containing numbers of flies typical of light (800-1,300), medium (1,400-2,000) and heavy (2,100-3,000) cultures showed that emergence in all cultures began on the 10th day after preparation, reached its peak on the 10th, 11th and 12th days, and covered a period of 2, 3 and 4 days, respectively, so that by using flies from medium cultures only on the 5th day after peak emergence, the flies would be 6, 5 and 4 days old, that is, of ages that have been found to differ little in susceptibility [cf. 26 86]. Slight differences in male percentages were also observed in successive batches of flies removed from stock cages in which the sex ratios were approximately 50:50.

In the second paper, a method is described that is designed to reduce the errors due to biological factors discussed in the first paper. Three battery-jar cultures are prepared at the same time, each receiving sufficient eggs to produce between 1,300 and 1,700 flies per jar (with populations not exceeding 1,700 larvae all tend to pupate on the same day). The pupae from the three jars are thoroughly mixed and weighed into groups of 500, and each group is placed in a cage with a capacity of about 1 cu. ft. and a floor surface of at least 1 sq. ft. The flies that emerge are kept for 5 days after the peak of emergence and supplied daily with fresh milk. The tests are made in the Peet-Grady chamber according to the usual procedure except that all flies from one cage are sprayed at one time. The regular Peet-Grady equipment is employed, but the stock cages and observation cages are replaced by one type of cage, which is described. One chamber can be kept in continual operation if 30-36 cages are used. One operator can evaluate with equal or better accuracy 12–18 samples a week instead of 5. Sex counting is avoided because each test unit contains approximately 50 per cent. males. Groups of 500 flies are handled almost as easily as groups of 100, and test units of 500 or more, when derived from thoroughly mixed pupae, have very uniform sex ratios. In addition, the method of obtaining the test unit ensures that it is a representative sample of the reared population. The number of replications necessary is greatly reduced, because several of the important sources of variation, formerly taken into account only by replication, have been controlled by other means. Evaluations of two particular samples by the modified method and by the regular

Peet-Grady method using flies in which the sexes had been counted and flies in which they had not, gave results that agreed in the first two cases.

Tuma (V.). Roaches. A Study of the Relationship between the Ages of Cockroaches and their Resistance to Insecticides.—Soap 14 no. 6 pp. 109-111, 113, 115, 117, 151, 4 graphs, 11 refs. New York, N.Y., June 1938.

Details are given of a number of experiments in which two liquid insecticides were tested against colonies of Blatella germanica, L., of known ages, to determine at what age they are most resistant to insecticidal action, and against colonies of mixed age obtained by natural breeding, to determine to what extent the results agreed or disagreed with those of the previous tests. In the room in which the cockroaches were reared, the temperature was maintained at a minimum of 85°F. and the relative humidity at a minimum of 60 per cent. To obtain batches of known age, egg-bearing females were isolated, and removed as soon as they had laid their eggs. The newly hatched cockroaches formed the basis of a colony, the age of which was definitely known at all times. The batches of mixed age were obtained from colonies that were allowed to propagate naturally.

The technique of testing is described, and the results of the tests are shown in tables. The data indicate that cockroaches are most resistant when 17 weeks old. The average number used in each test under identical conditions varied from 50 to 253, and within this range the number used had little effect on the ultimate results. Additional work indicated that the results obtained when larger groups were used were not reliable. In tests with the cockroaches of mixed ages, it was also found that the number used could be varied up to about 300 without affecting the results obtained. When larger groups were used the results were no longer reliable. These tests also indicated that results with cockroaches of mixed ages were not fully reliable even when a fair number of tests were conducted and the averages obtained. The results of individual tests were in much closer agreement when the cockroaches used were 17 weeks old. It is suggested that in a standard procedure for evaluating liquid insecticides for the control of cockroaches, each test should be carried out with 200 cockroaches 17 weeks old.

CAMPBELL (F. L.) & SULLIVAN (W. N.). Testing Fly Sprays: A Metal Turntable Method for comparative Tests of Liquid Contact Insecticides.—Soap 14 no. 6 pp. 119-125, 149, 4 figs., 10 refs. New York, N.Y., June 1938.

A detailed account is given of an apparatus evolved by the authors for testing toxic substances in mineral oil or synthetic organic solvents against house-flies [Musca domestica, L.]. Méasured amounts of the insecticide to be tested are sprayed at known pressure into 10 metal cylinders (17 ins. high \times 8 ins.), fitted on the top of a metal turntable so that they can be passed in rotation under the spray nozzle, which is mounted on pipes that pass up through the centre of the table. The flies in screened Petri dishes are placed in smaller cylinders, each

fitted beneath the table under a large cylinder. When a slide is pulled out, the spray-mist settles from the large cylinder into the small The possible advantages of this apparatus over the Peet-Grady chamber [cf. R.A.E., B 16 255] are that it costs less, requires less space, can be operated more quickly, gives greater uniformity of spray application, and can be more easily adapted for use with crawling or flying insects, or with water, oils or other liquids. The exact technique employed when using it is described at length. given of tests to determine the effect of altering the spraying pressure (using 5, 10, 15 and 20 lb. per sq. inch) and of delay in pulling out the slide between the large and small cylinders after spraying (using intervals of 0, 5, 10 and 15 seconds). The results show that an increase in either factor reduced the quantity of oil deposited by the settling mist during the 10 minutes exposure period and consequently lowered the mortality. These results may be partly explained by the fact that increased pressures reduced the mean size of the oil droplets, so that fewer are deposited within the 10 minute period of exposure, and that with increased delay more of the largest, most rapidly settling droplets are caught on the steel slide instead of settling in the Petri dishes. Mortality is also reduced by placing in the bottom of the Petri dishes absorbent paper, which absorbs the oil droplets and so removes them from subsequent contact with the flies. Tests with different periods of exposure showed that the increase in mortality with the longer periods cannot be attributed solely to the quantity of oil deposited, since this varied little after the first 5 minutes, but it may be due to the fact that the evaporation of the oil film on the insects is prevented while they are exposed to an atmosphere saturated with oil vapour, and the longer the film persists the more time the toxic solute has to produce its effect. The results of tests to determine the relative values of two samples of a kerosene-pyrethrum spray carried out in this apparatus and in Peet-Grady chambers in other laboratories compared favourably, and the average number of tests carried out per working day was about 2½ times as great with the former as with the latter. The conditions of the Peet-Grady method, however, simulate those under which liquid household insecticides are used in practice against house-flies and experience has shown that higher kills are obtained with this method than with the turntable in tests of pyrethrum and thiocyanate sprays. For these reasons the turntable is not recommended at present for comparative tests against house-flies of sprays that differ in the nature of their toxic ingredients, but it may be used satisfactorily for controlling the quality of an insecticide in factory production, where the only problem is to estimate the difference in effect due to variation in concentration of the active ingredients in successive batches of the product. Other uses to which it could be adapted and further improvements that could be incorporated in a new design to reduce cost and increase efficiency are suggested.

A method for obtaining an abundance of clean flies' eggs and for adding a definite quantity of them to a culture was also evolved. Flies do not readily oviposit when there is nothing in the cage except the cup of milk on which they feed, but when this is replaced by wads of cotton wool soaked in milk placed in the corners, many batches of eggs are deposited between the cotton wool and the corner. The eggs-suspended in water are poured into a 15 cc. graduated centrifuge tube and allowed to settle. When the volume they occupy reaches 1 cc. they are again suspended in water and thrown on to the breeding

medium. To avoid having to chill the adult flies in order to count them, random samples of clean puparia are collected within a limited period (by a method that is described), 115 are counted into a graduated centrifuge tube, the volume noted and further lots of puparia occupying the same volume are each placed in $5\frac{1}{2}$ -inch Petri dishes covered with 12-mesh screen. The adults, which emerge in 3 days in an incubator, are fed by means of milk-soaked cotton wool on a piece of filter paper placed on the screen. As about 90 per cent. emerge, each dish contains approximately 100 flies and is ready for testing.

Bruce (W. G.). A practical Trap for the Control of Horn Flies on Cattle.—J. Kans. ent. Soc. 11 no. 3 pp. 88-93, 3 figs., 3 refs. McPherson, Kans., July 1938.

A detailed account is given of a trapping device, simple in construction and relatively cheap, that gives promise of effectively controlling Lyperosia (Haematobia) irritans, L., and of greatly reducing the numbers of Stomoxys calcitrans, L., besides being useful in catching other flies that attack livestock. It consists of a passageway through which cattle pass and in which the flies on them are caught |c/. R.A.E., B 18 90]. The framework of timber is 5 ft. wide, 6 ft. high and 10 ft. long, and the roof is of wood. The passageway, 33 ins. wide, is formed down the centre by walls of heavy, large-mesh wire fencing. Behind the wire on each side are three traps, each $37\frac{1}{2}$ ins. wide, 10 ins. deep and 5 ft. high. They are made of 18-mesh galvanised screening; on the side facing the passage it is bent into a series of Z-shaped horizontal folds, along the inner angles of which are small slits for the flies to enter. Each trap has a door at the back for removing the dead flies. Curtains of heavy carpet, so fixed in the passageway between the pairs of traps that they brush the backs and sides of the cattle and six long weighted strips of carpet suspended at irregular intervals between the two sets of curtains serve to dislodge the flies. The construction admits as much light as possible, particularly on the side walls of the entrance section, a feature that prevents the escape of any great number of flies through the entrance opening. The trap should be situated where cattle are compelled to pass through it frequently, preferably in a lane leading to their water supply, or in a gateway through a fence round it. The animals, especially if they are wild range cattle, should be allowed to walk through the trap for a week or more before the curtains are installed in order that they may not be unduly alarmed.

In Texas during the summer of 1937 a trap of this type was used on a ranch that was divided into a number of pastures of approximately 500 acres, each containing about 40 head of cattle. The numbers of *L. irritans*, which were estimated at not less than 4,000 per head in all the pastures at the time the trap was installed, were reduced in 2 weeks and before all the curtains had been installed to one half as compared with the numbers on cattle in adjacent pastures, and after the third week the flies on the trapped pasture ceased to be troublesome. There was no reduction in the number of flies on adjacent pastures, a finding indicating that *Lyperosia* does not travel any considerable distance under range conditions. A similar trap, operating at a dairy, gave satisfactory control of *L. irritans* and greatly reduced the population

of S. calcitrans.

LINDQUIST (A. W.). A Study of the Incidence and Habits of Cochliomyia americana by means of Flytraps.—J. Kans. cnt. Soc. 11 no. 3-pp. 97-104, 1 fig., 2 refs. McPherson, Kans., July 1938.

These notes on the seasonal activity and prevalence of Cochliomyia hominivorax, Coq. (americana, Cush. & Patt.) in Texas are based on data obtained from fly-traps, chiefly one baited with beef liver and water and operated continuously at the same site from 15th July 1935 to 30th October 1937. This trap was emptied twice a month. The numbers caught were low in March, increased until they reached their peak in June, decreased during the hot dry months of summer, rose again slightly during the cooler autumn months, decreased again in November, and rose sharply for short warm periods in December and January. Activity, in so far as flight and feeding are concerned, occurred between semi-monthly mean temperatures of 45.3 and 88.2°F., but the population decreased considerably and rapidly when the mean temperature during the summer months reached 80°F. or above. The ratio of C. hominivorax to C. macellaria, F., averaged 1 to 912 during the 27½ months [cf. R.A.E., B **24** 102], but about half of the latter were males, whereas all the former were females. The ratios in the winter months (about 1 to 100) indicated that low temperatures affected C. macellaria more adversely than C. hominivorax. It is noteworthy that females of C. hominivorax, which have not been found to breed in carrion, are attracted to it to a certain extent. The average longevity after capture of 251 flies of this species trapped between April and December 1936 was 3.4 days with a maximum of 38.7, so that the life of a female attracted to carrion is not close to its end. The state of development of the eggs in flies caught over liver ranged from small to large, but 65 per cent. of the flies that lived 36 hours or less after capture contained immature eggs; a similar percentage was found in flies killed immediately after capture over various carcasses. In contrast, 89 per cent. of 112 flies caught on infested wounds of animals and examined 24 hours after collection contained large eggs apparently ready to be deposited. Carrion was apparently a preferred feeding medium and most of the flies visiting it were in the preoviposition stage; wounds were also feeding places, but most of the flies that visited them seemed to be ready to oviposit.

BISHOPP (F. C.) & SMITH (C. N.). The American Dog Tick, eastern Carrier of Rocky Mountain Spotted Fever.—Circ. U.S. Dep. Agric. no. 478, 25 pp., 13 figs., 15 refs. Washington, D.C.; April 1938.

A detailed account is given of the bionomics of *Dermacentor variabilis*, Say, which is the principal, if not the only vector of Rocky Mountain spotted fever in the central and eastern portions of the United States, where an average of 140 cases occurs annually with a death rate of 25 per cent. It is also a vector of tularaemia in man [cf. R.A.E., B 25 133] and animals and of anaplasmosis [Anaplasma marginale] in cattle. It is a serious pest of dogs, causing severe irritation and loss of condition, and often infests horses.

It is widely distributed throughout the United States east of the Rocky Mountains, in western and northern California, and in parts of Oregon; it is most abundant along the eastern coast from Massachusetts to Florida. It seems likely that low relative humidity

is the most important factor limiting its distribution and abundance in the eastern states. It is most numerous in areas covered with grass or underbrush and occurs less frequently in forests, where the species of mice that serve as hosts of the immature stages are less numerous. The dog is the chief host of the adults, though others of the larger mammals may also be infested. Rabbits appear to be of little

importance, and birds are not attacked.

Unengorged adults live for long periods; one female kept under observation lived at least 988 days and possibly as much as 1,053. Adults, as well as other stages, require considerable moisture, and if kept under dry conditions live for much shorter periods. The longevity of adults that have attached to hosts is comparatively short. of the males and slightly engorged females that are removed from a host die within a few weeks, though occasionally one may live for 5-6 months. This is of some importance, since the organism causing Rocky Mountain spotted fever is activated in the tick by feeding and such partly engorged ticks may transmit the disease during a very short period of attachment. Engorgement of females, which is retarded by the absence of males, normally requires 5-13 days. Pairing takes place on the host 4-6 days after attachment, but is always preceded by a feeding period in both sexes. The preoviposition and oviposition periods varied with the temperature from 3 to 24 days and 14 to 32 days, respectively. Eggs are laid in large masses in protected places on the ground; a female usually lays between 4,000 and 6,500 and dies 3-36 days after the completion of oviposition. The larvae remain in masses on the soil or on low-growing vegetation and, if conditions are sufficiently moist, survive for long periods. In the laboratory the maximum period was between 345 and 377 days. The average period for engorgement was 4.14 days. During the winter, the period during which the larvae dropped from the host was distinctly prolonged, though the period of engorgement was almost identical whether the hosts were kept in a warm or a cool room. The engorged larvae seek shelter on the soil surface. The period from dropping to moulting is markedly influenced by temperature; it varied from 6 days at about 84°F. to 87 days at about 55°. The maximum longevity of unfed nymphs kept on moist sand was between 274 and 309 days, but most of them did not live more than 6 months. The period required for engorgement averaged 5.2 days. The period from dropping to moulting ranged from 17 to 105–109 days, being greatly prolonged during cold weather.

The seasonal incidence of the adult ticks is discussed; it varies in different parts of the United States, but, in general, the adults are most abundant in spring and early summer, and their numbers diminish sharply in the hot, dry months in late summer. In the south, they have been taken in every month in the year, and breeding continues, though at a slower rate, throughout the winter. In the colder parts of the country, overwintering may take place in all stages but the egg. As few females become engorged and lay eggs in late summer, most eggs hatch before the onset of winter. Unfed adults found completely quiescent in clumps of bunch grass became active in a short time when warmed. Larvae and nymphs occur on mice and other small mammals throughout the winter; their numbers increase after periods of mild weather and decrease almost to nil after severe weather. It appears that ticks that engorge during the winter

all moult during a comparatively short time in spring.

Climatic factors are probably the chief ones exercising natural control of this tick, and of these excessive dryness is the most important. D. variabilis is very resistant to cold. Predators such as poultry, wild birds and mice doubtless destroy many ticks, especially engorged females. The need for further work on the parasite, Hunterellus hookeri, How. [cf. 25 159] is emphasised. In areas where there is an abundance of both small and large animals, the complete control of ticks by artificial means would appear to be almost impossible, but in certain areas large wild animals suitable as hosts for the adults are few or absent. and under such conditions the treatment of dogs would probably result in satisfactory control, particularly if measures were also taken to reduce the numbers of meadow mice (Microtus pennsylvanicus), the principal hosts of the immature stages. An effective dip or wash for dogs can be made by dissolving 1 oz. soap in 1 U.S. gal. water and adding 2-4 oz. derris powder with a rotenone content of 4 per cent. This treatment, which should be applied at intervals of 5-6 days. will greatly reduce the number of ticks that become attached and prevent engorgement and reproduction. Derris powder is easier to apply but is not so effective and should be used at shorter intervals (2-3 days). Other measures recommended include clearing undergrowth and keeping grass closely cut, especially near habitations, etc., and the use of clothing designed to prevent infestation when it is necessary to traverse infested areas.

Pechuman (L. L.). The Identity of Tabanus moerens Fabr.—Bull.

Brooklyn ent. Soc. 33 no. 3 pp. 136-137. Lancaster, Pa, June 1938.

From a comparison of the wing, which is all that remains of the type of *Tabanus moerens*, F., with wings of specimens of *Chrysops variegata*, DeG., sent to him by the author, Dr. O. Schröder concluded that they are identical. The author considers that this is sufficient evidence not only to confirm the conclusion reached by Philip from a study of Fabricius' description and published in a paper already noticed [R.A.E., B **20** 220] that T. moerens is a species of *Chrysops* (a fact necessitating the adoption of the name C. aestuans, Wulp, for C. moerens, Wlk. nec F. [cf. **11** 194]) but also to make it a synonym of C. variegata.

SANBORN (C. E.), STILES (G. W.) & MOE (L. H.). Anaplasmosis Transmission by naturally infected Dermacentor andersoni Male and Female Ticks.—N. Amer. Vot. 19 no. 1 pp. 31-33, 4 refs. Chicago, Ill., January 1938.

An account is given of experiments in Oklahoma in which anaplasmosis [Anaplasma marginale] was transmitted when 3 adult females and 4 adult males of Dermacentor andersoni, Stiles, (venustus, Banks), from a cow that had died of the disease in Wyoming [cf. R.A.E., B 24 23] were transferred to a healthy cow, and subsequently when the same 4 males alone were transferred successively to two other healthy animals. This appears to be the first case in which transmission by males has been recorded.

Pinto (C.). Zoo-parasitos de interesse medico e veterinario. Livro-para Medicos, Higienistas, Veterinarios e Estudantes, contendo as diagnoses das especies patogenicas para o homem e animaes domesticos da Região Neo-tropica, especialmente do Brasil. [Zoo-parasites of medical and veterinary Interest. A Book for Doctors, Hygienists, Veterinarians and Students, containing Descriptions of Neo-tropical, especially Brazilian, Species pathogenic to Man and domestic Animals.]—Imp. 8vo. [8] vii + 377 pp., 112 pls., 1 fldg. diagr., text ill., many refs. Rio de Janeiro, Pimenta de Mello & Cia, 1938.

The second part of this volume (pp. 45–172) deals with mites, ticks and insects, of which Diptera, especially mosquitos, are the subject of the largest section. The chapter on each order or family has notes on its characters and classification, keys in some cases to the more important genera and species, figures illustrating the morphology, notes on pathological importance, and a bibliography. The last chapter is a brief survey indicating the measures applicable against the various groups of pests.

ALICATA (J. E.). Studies on Poultry Parasites.—Rep. Hawaii agric.. Exp. Sta. 1937 pp. 93-96. Honolulu, March 1938.

A list is given of the helminth parasites of fowls in Hawaii showing, where possible, their natural and experimental intermediate hosts. Dispharynx spiralis has been found in the wood louse, Porcellio laevis, Latr.; Tetrameres americana in the earwig, Anisolabis (Euborellia) annulipes, Lucas, the cockroach, Blatella germanica, L., the Amphipod, Orchestia platensis, Kröver, and the beetles, Dermestes vulpinus, F., Dasus (Gonocephalum) seriatus, Boisd., Epitragus diremptus, Karsch, and Dendrophilus sp.; Choanotaenia infundibulum in the first three beetles; Raillietina cesticillus in the first two; Cheilospirura hamulosa in Tenebroides nanus, Melsh., E. diremptus, O. platensis, and certain species of grasshoppers; and Hymenolepis exigua in O. blatensis. In addition to these cases of natural infection, experimental infections have been obtained with Oxyspirura mansoni in the cockroach, Pycnoscelus surinamensis, L., with Tetrameres americana in the grasshopper, Conocephalus saltator, Sauss., and with Cheilospirura hamulosa in various beetles and grasshoppers [cf. R.A.E., B 25 218]. Possible methods of controlling Pycnoscelus surinamensis are briefly discussed.

Foot Lice in Sheep: Need for Vigilance.—Agric. Gaz. N.S.W. 49 pt. 6 p. 308. Sydney, June 1938.

Attention is called to the prevalence of the foot louse ($Linognathus\ pedalis$, Osb.) on sheep in New South Wales. It is usually found on the lower part of the legs below the true wool in the short coarse hair, and is often localised around the dewclaws and coronet. Dipping mixtures of sufficient strength to kill the body louse [$Bovicola\ ovis$, L.] have proved ineffective against $L.\ pedalis$ and its eggs, and an increase in concentration irritates the skin. Arsenical dips containing derris compounds have given satisfactory results. When only small numbers of sheep are affected, the foot and the lower part of the leg, from which the wool has been sheared, should be placed in a receptacle containing a mixture of 2 oz. commercial nicotine sulphate (40 per cent.) with

1 pint warm soapy water, which should then be worked into the affected parts. A second application may be necessary in some cases, but one is usually sufficient. The mixture may be too expensive for use in a long foot bath. Any infested wool that has been cut away should be burnt.

CLAY (T.). A Revision of the Genera and Species of Mallophaga occurring on Gallinaceous Hosts.—Part I. Lipeurus and Related Genera.—Proc. zool. Soc. (B) 108 pt. 2 pp. 109-204, 14 pls., 45 figs., 49 refs. London, July 1938.

The known species of *Lipeurus* and related genera are discussed fully, and 42 new species and subspecies are described. The four genera recognised are *Lipeurus*, *Oxylipeurus*, *Lagopoecus* and *Gallipeurus*, gen. n., of which the type is *Lipeurus* heterographus, Nitzsch. Other species of which the genera are changed include *Lipeurus* dentatus, Sugimoto (denticlypeus, Sugimoto [R.A.E., B 23 175], angularis, Peters [23 168]) and *L. polytrapezius*, Nitzsch, which are referred to *Oxylipeurus*, and *Philopterus* kozuii, Sugimoto [23 175], which is referred to *Lagopoecus*. A list of species of Mallophaga erroneously recorded from gallinaceous hosts is given.

LAING (F.). The Coekroach. Its Life-history and how to deal with it.—Econ. Ser. Brit. Mus. (Nat. Hist.) no. 12 (3rd edn.), 24 pp., 10 figs. London, 1938. Price 6d.

Additional material in this revision of a pamphlet on cockroaches already noticed [R.A.E., B 19 100] includes information on their parasites, of which Evania appendigaster, L., E. dimidiata, Spin., and E. punctata, Brullé, are the most important, on structural details that must be considered if the infestation of flats in converted houses or new blocks is to be prevented, and on sprays consisting of thiocyanates used at the rate of 10 per cent. in kerosene, which appear to be as effective as the pyrethrum-kerosene spray [loc. cit.] and have the advantage of being colourless.

TARANTINO (G. B.). La tripanosomiasi nel Galla e Sidama. [Trypanosomiasis in the Galla and Sidama Territory.]—Riv. Biol. colon. 1 fasc. 3 pp. 161-164. Rome, June 1938; also in Clin. vet. 61 no. 7 pp. 389-390. Milan, July 1938.

Both Glossina morsitans, Westw., and G. palpalis, R.-D., have been recorded in the Galla and Sidama territory, south-western Abyssinia, at no great distance from foci of sleeping sickness in Uganda and the Sudan. Trypanosoma brucei and T. congolense have been found in horses in the territory, in which all zones below about 4,300 ft. must be considered dangerous.

Brumpt (E.). Le paludisme des buffles existe-t-il en Indochine et peut-il fausser les indices oocystiques et sporozoitiques établis dans diverses régions asiatiques ?—Bull. Soc. Path. exot. 31 no. 6 pp. 479-483, 1 fig., 8 refs. Paris, 1938.

The author discusses the finding by Toumanoff in Cambodia of malaria parasites in two females of *Anopheles minimus*, Theo., that had been caught in nature 25 and 21 days prior to dissection [R.A.E., B.] 26 61]. He considers it unlikely that parasites of human malaria could have persisted for so long, and suggests that they were malaria

parasites obtained from the buffalos on which the mosquitos had been fed in the interim. *Plasmodium bubalus* was described from buffalos in India in 1919 but is not known to be transmitted by Anophelines.

BACIGALUPO (J.) & AGUIRRE PEQUENO (E.). Un nouveau cas d' Hymenolepis diminuta chez l'homme, au Mexique.—Bull. Soc. Path. exot. 31 no. 6 pp. 502-504, 2 refs. Paris, 1938.

Hymenolepis diminuta is recorded from the faeces of a child in Mexico. This tapeworm is a common parasite of rats in Mexico City. Since in Argentina 4 out of 411 examples of Xenopsylla cheopis, Roths., had been found infected, a collection of X. cheopis from Mexico was examined and 2 females out of 227 examples were found to harbour the cysticercoids.

JOYEUX (C.). & SAUTET (J.). Recherches épidémiologiques sur la leishmaniose viscérale méditerranéenne.—Arch. Méd. gén. colon. 7 no. 2 pp. 39–41. Marseilles, 1938.

JOYEUX (C.) & SAUTET (J.). Observations sur la leishmaniose canine méditerranéenne.—Bull. Soc. Path. exot. 31 no. 6 pp. 487-490. Paris, 1938.

In the first paper, the authors discuss briefly the literature on the transmission of visceral leishmaniasis of the Mediterranean region, which they consider to be primarily a disease of dogs that is only occasionally transmitted to man [cf. R.A.E., B 24 85], and give a short preliminary account of a case in a dog, which is described at greater length and with additional details in the second paper.

The parasites were observed not only in dermal smears but also in the form of Leishmania (simple or in the process of division) or in the tlagellate form in the digestive tract of the lice (Linognathus piliferus, Burm.) harboured by the animal. There was a direct correlation between the variations in the frequency with which the parasites occurred in the skin of the dog and in the intestines of the lice. No cysts were observed in the latter. Unsuccessful attempts were made to transmit the flagellate forms to young dogs by making a suspension of infected lice and inoculating it into the peritoneum, placing it on scarifications of the skin or in the conjunctival culs-de-sac, or allowing them to feed on it. It seems likely that the parasites in the lice are the same as those observed in the dog, but it is possible that they are flagellates proper to the louse. The lice disappeared when a furfuraceous dermatitis developed on the dog, probably owing to the difficulty of obtaining blood through a skin covered with scales. No developmental forms of Leishmania were found in 12 examples of Triatoma infestans, Klug, or in about 200 larvae of Rhipicephalus sanguineus, Latr., that had been reared in the laboratory and allowed to feed on the dog at a time when Leishmania were abundant in dermal smears. or in 10 examples of R. sanguineus that were found on the dog at a later date.

Sautet (J.). Étude critique du rôle de divers arthropodes dans la transmission de la peste.—Arch. Méd. gén. colon. 7 no. 2 pp. 42-49. Marseilles, 1938.

The author reviews from the literature the chief factors that determine the part played by various species of fleas in the transmission of plague in different parts of the world. Those influencing their multiplication or destruction, their longevity, their distribution, and their degree of infection and its persistence are dealt with in separate sections. Brief notes are also given on the other Arthropods that may possibly be concerned in transmission in exceptional circumstances.

OHTOMO (T.), KOGA (S.) & TANAKA (I.). Rats in the Kobe Customs Sheds and the Fleas found on those Rats.—J. publ. Hlth. Ass. Japan 13 no. 10 (Engl. Sect.) pp. 1–6. Tokyo, October 1937.

In the course of the destruction of rats at the Kobe Customs warehouse from 1st to 25th October, observations were made on the proportion of the species and on the species and numbers of the fleas they harboured. The results are given in the present paper and compared with those of similar surveys carried out on shore in the cities of Tokyo and Kobe and in ships. The order of relative prevalence of the rats was Mus (Rattus) rattus alexandrinus, M. (R.) norvegicus and M. (R.) rattus rattus on the Customs jetty, M. r. alexandrinus, M. r. rattus and M. norvegicus in ships and M. norvegicus, M. r. alexandrinus and M. r. rattus on shore. A total of 156 rats were examined for fleas; 46 were uninfested and the rest harboured 878 fleas, of which 664 (75.62 per cent.) were Xenopsylla cheopis, Roths., 185 (21.07 per cent.) Ceratophyllus fasciatus, Bosc, 12 (1.36 per cent.) C. anisus, Roths., 12 (1.36 per cent.) Echidnophaga gallinacea, Westw., and 5 (0.56 per cent.) Leptopsylla segnis, Schönh. (musculi, Dugès). In the cities of Tokyo and Kobe, C. fasciatus was the most prevalent flea, C. anisus the next most numerous, and the proportion of X. cheopis remarkably low.

DEVIGNAT (R.). L'utilisation du milieu de Broquet pour la recherche de la peste des puces.—Ann. Soc. belge Méd. trop. 18 no. 2 pp. 215-219. Brussels, 30th June 1938.

Broquet's medium (2 gm. calcium carbonate, 20 cc. glycerine, 80 cc. distilled water) has been employed since September 1937 for conserving fleas taken from rats in the course of routine monthly surveys of villages in the Lake Albert region of the Belgian Congo, where plague occurs in man [cf. R.A.E., B 25 212]. Its use not only enables them to be identified easily, but also permits the survival of any plague bacilli that may be present in them. Thus, if a guineapig inoculated with a small amount of an emulsion of the bone marrows of all the rats collected in a certain village dies of plague, the fleas taken on the same rats on the same day can be identified and the different species inoculated into separate guineapigs. A strain of plague has recently been recovered in this manner from a batch of Xenopsylla brasiliensis, Baker, taken from Mastomys coucha var. ugandae and preserved in Broquet's medium for 30 hours.

Schwetz (J.) & Baumann (H.). Recherches sur le paludisme endémique chez les noirs de l'agglomération de Coquilhatville.—Ann. Soc. belge Méd. trop. 18 no. 2 pp. 259-276, 3 refs. Brussels, 30th June 1938.

Details are given of a malaria survey carried out at Coquilhatville, Belgian Congo, in 1937, which showed that *Plasmodium vivax* was absent and *P. malariae* very rare, and that the rate of infection with

P. falciparum, which was low, was higher in the older age groups than in infants. The latter finding is apparently characteristic of areas of low endemicity. Anopheles moucheti, Evans, appears to be the most numerous Anopheline, but examples of A. coustani, Lav. (mauritianus, Grp.) have also been collected. It does not seem probable that the low degree of endemicity is accounted for by the absence of A. gambiae, Giles, since A. moucheti was found to have a fairly high rate of infection at Stanleyville [R.A.E., B 17 113]. It is tentatively suggested that the absence and rarity of P. vivax and P. malariae, respectively, might be due to the unsuitability of A. moucheti as a host for these species.

ADLER (S.), THEODOR (O.) & WITENBERG (G.). Investigations on Mediterranean Kala Azar. XI. A Study of Leishmaniasis in Canea (Crete).—Proc. roy. Soc. (B) 125 no. 841 pp. 491–516, 3 figs., 15 refs. London, 5th August 1938.

A rapid survey carried out in 1932 in Athens and the vicinity of Argos indicated that the distribution of *Phlebotomus major*, Ann., corresponded closely to that of visceral leishmaniasis [cf. R.A.E., B 23 122]. In order to confirm the relation of this species to the transmission of the disease in Greece and to ascertain the part played by other species of the *major* group as vectors, an intensive study was carried out at Canea (Crete), which is a focus of both visceral and dermal leishmaniasis. About 7,000 female sandflies collected at Canea between the beginning of July and 20th November 1934 comprised *P. papatasii*, Scop., *P. major*, *P. chinensis* var. simici, Nitzu., *P. sergenti*, Parr., and *P. parroti* var. italicus, Adl. & Thdr., which in

Crete feeds mainly on geckos and never on man.

The following is taken largely from the authors' summary: The epidemiology of leishmaniasis in Canca is discussed. The distribution of human and canine visceral leishmaniasis there is identical with that of P. major, which is the only sandfly of importance in transmission. P. tobbi, Adl., Thdr. & Lour., and P. perfiliewi, Parr., were not found, and P. chinensis var. simici was not common. An account is given of the bionomics in Canea of the species referred to as P. major, since they differ from those of the P. major studied in Catania (Sicily). A single example of the hitherto unknown male of P. larroussei, Lngn. & Nitzu., which was taken in Serakino (Crete), is described. The relation of this species to P. vesuvianus, Adl. & Thdr., and P. canaaniticus, Adl. & Thdr., is discussed [cf. 19 218; 20 98; 24 160], and it is concluded that the second is a synonym and the third a variety of the first; the distinction between the first two rests on a doubtful minor character of the spermathecal duct. The clinical condition of dogs naturally infected with visceral leishmaniasis was improved and the infection rate in examples of P. major fed on them was reduced when they were placed on a diet of fresh meat without any other treatment. Examples from Crete of P. major, P. chinensis var. simici, P. sergenti and P. papatasii became infected with Leishmania infantum when fed on rodents infected with human strains from Malta and Greece; the infection rates in P. sergenti and in P. papatasii were very low as compared with that in P. major.

Though no part of Canea is free from Oriental sore, the disease is particularly common in the old Turkish city, where a sandfly survey indicated the prevalence of *P. papatasii* and *P. sergenti*, the rarity of

 $P.\ major$ and the absence of $P.\ chinensis$ var. simici. The first three species all became infected with $L.\ tropica$ when fed on cutaneous lesions in man in Canea; the infection rate in $P.\ papatasii$ was very low when compared with that in $P.\ sergenti$, which appears, therefore, to be the main vector. The Canea strain of $L.\ tropica$ differs biologically from that of Palestine; it produces a very low infection rate in examples of $P.\ papatasii$ from both Crete and from Palestine. A volunteer was infected with $L.\ tropica$ by the cutaneous inoculation of flagellates from an artificially infected example of $P.\ sergenti$. The general distribution of sandflies of the major group with relation to visceral leishmaniasis in the eastern hemisphere is reviewed.

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- Peters (H. S.). A List of External Parasites from Birds of the eastern Part of the United States [including Haemaphysalis leporis-palustris, Pack., on 46 species and Liponyssus sylviarum, C. & F., on 22].—Bird-banding 7 no. 1 pp. 9-27, 4 refs. Boston, Mass., January 1936.
- HERMAN (C. M.). Occurrence of larval and nymphal Stages of the Rabbit Tick, Haemaphysalis leporis-palustris, on [6 species of] Wild Birds from Cape Cod.—Bull. Brooklyn ent. Soc. 33 no. 3 pp. 133-134. Lancaster, Pa, June 1938.
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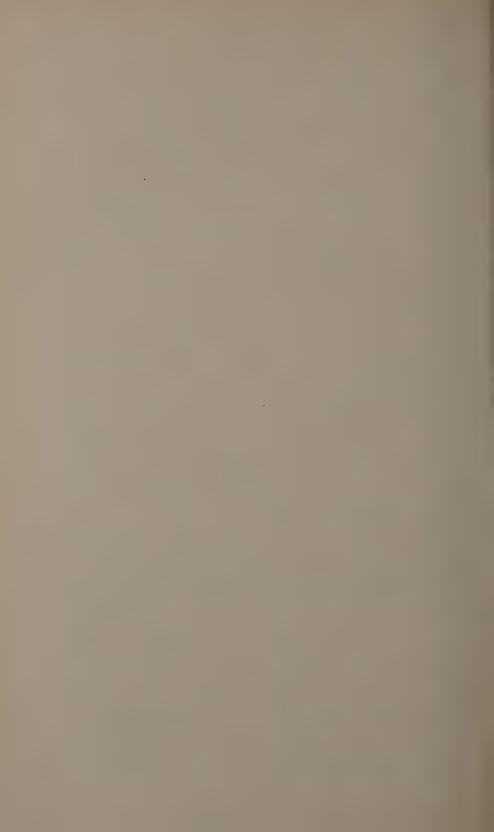
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